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[OFFICIAL NOTICE.]

Twenty-Third Annual Meeting, Western Gas Association.

WESTERN GAS ASSOCIATION,
OFFICE OF THE SECRETARY,
NEW ALBANY, IND., April 9, 1900.

The twenty-third annual meeting of the Western Gas Association will be held in Chicago, May 16, 17 and 18, 1900, and will be called to order by the President, Mr. Wm. McDonald, of Albany, N. Y., at 9:30 A. M., Wednesday, May 16th.

The Auditorium Hotel has been selected as headquarters, and the meetings will be held in a suitable room contained therein. The following rates have been obtained for members and any who may attend the meeting:

European Plan.—$2.50 per day and up; two, in one room, $1.50 per day each, and up; room with bath, one person, $3.50 per day; two persons, $5.

American Plan.—$4 to $5 per day.

The Executive Committee has arranged for the presentation of the following papers:

"Candle Power: Its Present Relation to the Gas Industry;" by Mr. Jno. R. Lynn, Portsmouth, Ohio.

"The Operation of a Central Station Electrical Plant with a Gas Engine;" by Mr. J. C. Small, Aurora, Ind.

"Public Control of Rates;" by Mr. Geo. McLean, Dubuque, Iowa.

"The Systematic Location of Gas Mains as Opposed to a Conduit;" by Mr. Donald McDonald, Louisville, Ky.

"Temperatures in Condensation;" by Mr. W. H. Barthold, Grand Rapids, Mich.

"Regenerative Benches;" by Mr. Howard C. Slater, Milwaukee, Wis.

"Monthly Technical Report of Operations in Coal Gas Works;" by Mr. W. E. Steinwedell, Belleville, Ills.

"The Hygienic Effect of the Use of Gas;" by Mr. Thos. D. Miller, Dallas, Texas.

"Wrinkle Department;" Edited by Mr. Fred. H. Shelton, Philadelphia, Pa.

Reports will be received from the Committee on Cyanides and from the Committee on Isolated Generators for Bench Firing. Mr. Somerville will present a "Short Topic" relating to an experience in telescoping a gas holder.

The Western Passenger Association, from points in Eastern and trans-Missouri territories, Central Passenger Association, Trunk Line Association, Southeastern Passenger Association, Wisconsin Central Lines, Chicago, Rock Island and Pacific Railway Company and the Chicago and Alton Road, have granted rates of one and one-third fare for the round trip, conditioned on 100 certificates being presented to the Secretary for indorsement. The territory embraced by the above Associations includes all State divisions east of the Mississippi river, except New England. The following States and Territories west of the Mississippi river are in the territory covered by the Railway Associations granting reductions: North Dakota, South Dakota, Minnesota, Wisconsin, Iowa, Missouri, Nebraska, Kansas, Oklahoma, Indian Territory, Colorado and Utah.

All persons attending the meeting will purchase a first-class ticket at starting point, paying full fare for same, obtaining from agent a certificate stating that the person whose signature appears on same has purchased, at full tariff fare, one first-class ticket to Chicago, which certificate, after it has been signed by the Secretary of the Association and a representative of the above Passenger Associations, will entitle the purchaser to a one-third rate returning home.

Apply to ticket agent at least 30 minutes before departure of train. All station agents do not have a supply of certificates, but they can be obtained by request, if notification is made in time. Persons outside the territory embraced by the Passenger Associations mentioned above should purchase a ticket to nearest point within one of said Association, and from there purchase a ticket to Chicago, obtaining a certificate which will, if properly endorsed in Chicago, entitle them to a one-third fare returning to place from which certificate was obtained, provided it is endorsed by a representative of the Passenger Associations, who will be present at the meeting, and the undersigned.

Those who live in Western Passenger Association territory should consult local agents several days in advance of purchasing ticket to Chicago, in order to reach an understanding with the different roads as to the junction point via which they will make rates applicable. Some local agents sell to junction points, where delegates can re-buy to destination. Certificates held by wives of the delegates attending the meeting will be honored in the same manner as those held by the delegates themselves.

A beefsteak dinner, to be provided by the Association, will be held Thursday evening, at the Chicago Athletic Club, tickets for which will be sold at $5 each. While the ladies will not participate in the dinner, arrangement will be made for their entertainment.

As it is necessary that arrangements for this dinner should be perfected at an early date, it is requested that all those who expect to attend the meeting will notify Mr. H. D. Harper, Chicago, Ills., of the Committee, as early as possible of the number of tickets they will require.

All queries sent to the Secretary for the Question Box will be assigned, in advance of the meeting, to members for answer.

The Secretary will be pleased to answer any communication pertaining to the meeting, and will mail blank applications to any who desire to become members of the Association. JAMES W. DUNBAR, Secy.

BRIEFLY TOLD.

MR. A. G. GLASGOW IS AWARDED THE BEAL MEDAL.—The Committee appointed at the last meeting of the American Gas Light Association by its Council, to determine who of the writers that submitted papers for that meeting was entitled to the award of the Beal medal, have presented their report. This medal, which is annually bestowed by Mr. William R. Beal, of New York, was, in 1898, awarded to Mr. Henry L. Doherty, then of Madison, Wisconsin, for his paper on "How Can We Make the Use of Gas for Cooking More Universal?" This honor for 1899 goes to Mr. A. G. Glasgow, of Humphreys & Glasgow, New York, for his paper on "Carburetted Water Gas as a Coal Gas Auxiliary." The official report of the Committee announcing the award is as follows:

MARCH 24, 1900.

Mr. A. E. Forstall, Secy. American Gas Light Association:

Dear Sir—The Committee to whom was referred the award of the Beal medal, for the best paper read at the meeting of the American Gas Light Association, held in New York on October 18th and 19th, 1899, report that they have given the matter careful consideration, and their conclusions have been reached after some delay because there were a number of papers read at the meeting of great excellence, showing that the authors had devoted much time and pains in their preparation, and the task imposed on your Committee has not been very easy.

We think that, all things considered, the medal should be awarded to Mr. Arthur G. Glasgow, M.E., M. Inst. C. E.

Mr. Glasgow has treated his subject, "Carburetted Water Gas as a Coal Gas Auxiliary," in a masterly manner. The paper is broad in its scope and of great and general usefulness to the gas engineer. The deductions are reached by the author after a thorough analytical examination of all the underlying bases of gas manufacture. The paper exhibits, in a marked degree, the results of the large and varied experience of a gas engineer. Yours with respect,

EUGENE VANDERPOOL,
A. B. SLATER,
CHAS. H. NETTLETON,
} Committee.

SECOND ANNUAL MEETING, SOUTHWESTERN GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION.—"The proceedings of the second annual meeting of the Southwestern Gas, Electric and Street Railway Association were successfully carried out the 12th, 13th and 14th days of this month, at Waco, Texas, under the direction of the President, Mr. Thomas D. Miller, of Dallas, Texas, assisted ably by the Secretary, Mr. T. H. Stuart, of Waco. The meetings were held in the handsome assembly rooms of the Business Men's Club, with the finest of Texas weather, an excellent attendance and right good fellowship as the garnishings. The representation was perhaps more on the electric lighting end than of the gaseous order, but it may be asserted truthfully that the few gas men present were quite up to the mental candle power of their current compeers. President Miller's address was in his best vein, and the papers, although the tenor thereof was quite like the representation, were put together to the point of eliciting good discussion. A point in President Miller's address, respecting the unfortunate break or smash of the Austin (Tex.) government by-the-people dam, is well worth thinking over. The officers elected were: President, Mr. J. F. Strickland, Waxahachie, Tex.; First Vice-President, C. F. Yeager, Laredo, Tex.; Second Vice-President, E. H. Jenkins, San Antonio, Tex.; Third Vice-President, J. R. Cullinane, Denison, Tex.; Directors, to serve 2 years, Messrs. H. F. McGregor, Thos. D. Miller and W. S. Rathell. Houston was named as the next meeting place. The social features, and general entertainment as well, were of an order that caused those who shared them to enjoy them. Prominent therein, and pleasing to the last, was the reception tendered the delegates by Mr. and Mrs. W. S. Rathell (Rathell is the clever Waco gas man), at their residence, the evening of the first day. The reception was followed by a 'jolly smoker' at the Hotel Royal. The 'night of the second day' found the boys in the hands of the 'Sons of Jove,' who knew their business all right. Brothers Rathell and Stewart railroaded the delegates to a finish the afternoon of the last day, and everybody enjoyed the ride. The meeting was in every way and from every point of view a complete, thorough success.—TEXAS."

OBITUARY NOTE, ANDREW L. CONEIRY.—On the 15th inst. the JOURNAL lost a valued helper, when death took from it Mr. Andrew L. Coneiry. Born in Brooklyn, N. Y., August 20th, 1855, deceased acquired his education in that city, graduating from Public School No. 9, in the Class of 1871. From thence to the office of the Brooklyn *Daily Eagle* was his next step. Mastering there the printer's trade, he took service with the JOURNAL, in August, 1878, and with it and of it he has since been a part. He served it well and faithfully, and of whom may more be said.

[Prepared for the Journal.]

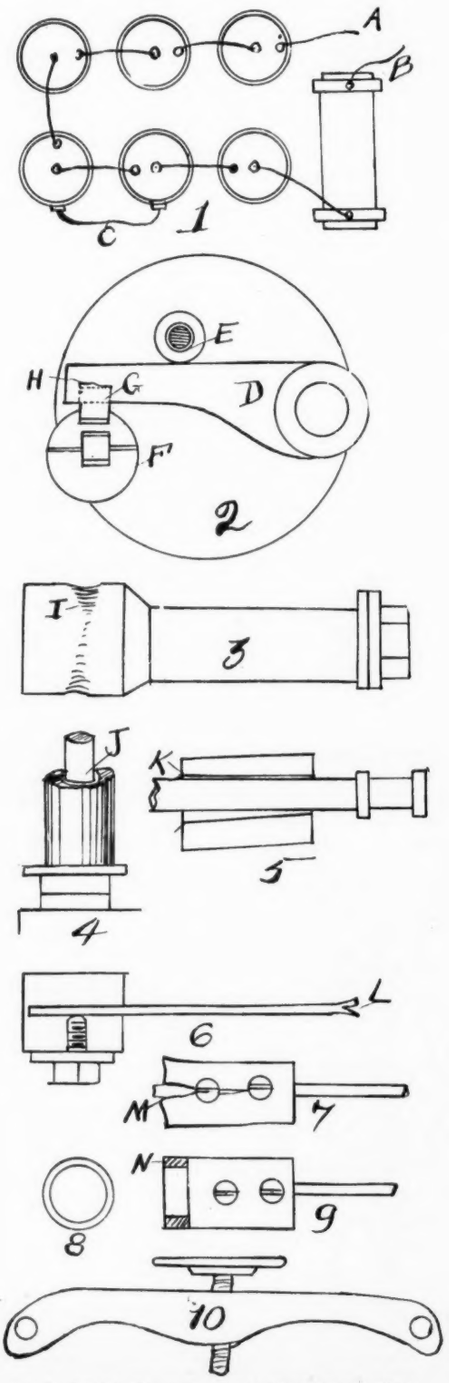
Mechanical Wrinkles for Gas Machinists.

By MR. GEORGE D. RICE.

The Electric Igniter.—The electric spark system of ignition for gas engines and for other purposes of a like character is more complicated than the simple tube ignition method, and some mechanical ability to care for and adjust it is required. The tube ignition system has been substituted by the electric spark system in many places where they are employing a large number of gas engines or gas apparatus of any sort requiring the use of igniters.

There are ordinarily two systems of the electric igniter, and often both systems may be found in use in one plant. The primary coil system is the one most generally used, in which the electrodes are caused to operate as circuit breakers, one being a fixed and the other a movable electrode. The other system has the regular coil and outside circuit breaker, and both electrodes are fixed.

The drawing in Fig. 1 is intended to show the method of connection



Details of Points Concerning Care and Repair of Igniters.

in a 6 cell battery with spark coil. The terminals are marked *A* and *B* respectively, and connect with the two electrodes.

What to Examine.—In the event of the device giving poor service the gas machinist should examine the machine to see if the electrical contact between electrodes is effected at the right time. Frequently the writer was shown systems in which the service rendered was very poor indeed, and all due to improper electrical contact. Sometimes the igniter may be found to be so poorly constructed that proper electrical contact between electrodes cannot be accomplished, in which case the setting and general adjustment and plan of the machine should be overlooked and the defective point rectified if possible, even if some extensive alterations have to be made. The igniter should also be qualified for extremely prompt separation of electrodes at all speeds of the engine. If the igniter is weak in this respect, the gas machinist should either reject it or endeavor to have the imperfect portion fixed.

Should be Easy to Get At.—The accessibility of electrodes for cleaning and adjusting forms an important item in the care and maintenance of the igniter. There are some machines on the market which are well planned, so far as effective service is concerned, but for which no adequate provisions were made for cleaning and adjusting. Consequently, the parts soon become gummy and soiled and operate hard, and cause the work of the igniter to drag, and in time may put the device out of use altogether. Other types of igniters are so built that the machinist can readily reach any part for setting and the cleaner any part for cleaning, with the result that one has a good, smooth-working igniter instead of one clogged with waste and gum and poorly adjusted.

Care should be taken to examine all parts of the device for defective workmanship, for untrained machinists will often ruin an igniter. In one case the writer found that a new machinist had connected in an additional piece of wire between the walls of two cells, as at *C*, Fig. 1, and he could not explain why he did so. As soon as this odd attachment was removed the igniter operated satisfactorily.

Spark has an Oxidizing Effect.—As is known to gas machinists, the electric spark system has an oxidizing effect and it is necessary to employ metallic points which will withstand the powerful strain. Platinum is usually considered the most effective, and this material is ordinarily employed. Fig. 2 shows the plan in which the movable electrode is indicated *D*, the fixed electrode *F*, the platinum point *G*, and the stud or stop for preventing the electrode from rising up and out of position is shown at *E*. The principal trouble found by the writer in these igniters is that the platinum is sometimes permitted to become worn or to shift its position. If the seat for the platinum is untrue there will constantly be trouble with the whole affair. In the present illustration the seat is shown as being untrue at *H*, thus permitting the platinum to tip to one side and perhaps loosen and work out of place. The remedy consists in cutting the seat true or in making a piece of platinum which will exactly fit in the cavity. Also, examine all parts of the igniter for loose bolts, screws and nuts, and if any are found out of order they should be promptly attended to. All worn parts should be looked for and replaced with new. Oil holes should be cleaned out and the new oil started to passing through so as to effect a perfect lubrication of all bearing surfaces, reducing friction thereby and assuring more uniform service.

When the Stop is Worn.—At *I* in Fig 3 is shown one of the stops of the igniter in a worn condition. The metal has been completely worn from the marked portion as a result of long service, and the stop loses its effectiveness and steadiness and should at once be replaced with a new one, or, if desired, the same stop can be used again by turning down the worn portion and providing a steel bushing. I have noticed quite a number of igniters running under difficulties simply because of the worn condition of the bearing surface of the stops. If the stop is fitted with a cam, then this cam should always be free and in condition to revolve readily on the stud. If the ring is worn put on a new one.

The Insulation.—The insulating material is also of considerable importance and an investigation should frequently be made to see if it is in proper shape. In Fig. 4 is the form of the insulation, and the liability is that it will become thinned at *J*, where it contacts with the metal, and if this is the case, new insulating material should be provided. If there is any hammering sound heard the parts should be examined to see if the surfaces touch evenly, for if they do not, the jarring will cause the knocking noises and produce imperfect service. Sometimes the bushing of the sleeves is worn down at one side, as at *K*, Fig. 5, in which event new bushings are needed, or the old ones may be utilized, if made true by cutting down and then fitted with lining.

Igniter Wire Split.—In Fig. 6 is seen the style of igniter commonly employed, and in some cases the writer has found that extremely bad work has been secured owing to the end of the tongue being split at *L*. Sometimes this tongue gets bent, and it can be readily fixed by straightening, but when it splits the only remedy is to clip off the bad end and make up the length by loosening the clamping screws in the hub and moving the wire out a little.

Split Hub.—In Fig. 7 is a hub split at *M*. This may be repaired by removing the tongue and then cutting down the flange of the hub so as to slip on a ring, like that in Fig 8. The ring in position on the hub, in section, is shown at *N*, Fig. 9. This form of repair will be found to be very strong and lasting. In Fig. 10 is shown a simple drawing device which is useful for gas machinists in connection with gas engine repairs and general work about a gas plant. The arm itself is wrought iron, tapped in the center for the pressure screw and wheel, as shown, and the ends are also bored so as to permit the use of a chain or link when required.

Address of the President (Mr. Thomas D. Miller, of Dallas, Texas) on the Occasion of the Second Annual Meeting of the Southwestern Gas, Electric and Street Railway Association.

Southwestern Gas, Electric and Street Railway Association:

In May, 1896, a few electric light men and fewer gas men formed the Texas Gas and Electric Light Association. That it was experimental no one can question, as it was the first Association formed in this country, if not in the world, composed of exclusive gas men and exclusive electric men and combination men.

In March, 1898, this Association met in joint session with the Texas Street Railway Association, at Laredo, and formed the present Association, thus bringing together in one Association three industries with apparently very wide differences in their character of business. But a careful examination will show that, with the exception of distinctive technical and business details, the same subjects interest them all.

The past year has been noted for its great activity in industrial enterprises, with the natural rise in prices of supplies. Those who lived up to the old precept "In time of peace prepare for war," and took advantage of the low prices to make extensions and improvements, find they are able to show a large profit on the investment in the amount saved in the expenditure over what the same would have cost had it been deferred a year or more. Competition has in numerous cases been tempered by consolidation or the courts. The anti-trust law has been declared constitutional, but no case has been reported where it has affected any of our industries, for the simple reason that, forsooth, none of us are in a trust.

A popular cry in municipal affairs to day is municipal ownership of public or semi public utilities, which include gas works, central station electric plants and street car lines. That this is of interest to us all I have no hesitancy in affirming, and you may expect a careful paper on this subject at this meeting, and I hope a thorough discussion of it. There has been considerable educational work done on this subject the past year, and it is to be hoped it will continue. One of the principal causes of this great wave has been the unfounded and erroneous idea that is prevalent in the public mind as to the earnings of such institutions. There have been cases where city authorities have been unable to get the consent of the public for the purchase of such utilities, and, still laboring under the delusion that the profits of the business were enormous, they attempted to and have imposed heavy burdens in the shape of a privilege tax or income tax or bonus for the occupancy and use of the streets. The injustice of such course must be apparent to all, for such levy or impost must be paid by the patrons of the enterprise, which payment accrues to the benefit of all at the expense of a few. It is argued that our business is in its nature exclusive, and that it is impracticable to have competition in the sale of gas, electric lights and transportation of passengers. This statement is in a measure true, but the impracticability is not physical but financial, as some of you here can testify from more or less lurid experience. If our profits are sufficient to enable us to give large bonuses to the government for a privilege to do business, would it not be more logical for us to give that amount to our customers in the shape of lower prices. An adjustment of this nature would I believe meet with approval from all interests involved, could the subject be treated in a perfectly impartial way.

Our meeting last year was held in Austin, and the time selected for it was in April, but at the request of the local committee, influenced by the Business Men's Club of that city, our meeting was postponed until May. The reason assigned for this action was the scarcity of water in the Colorado river, there not being sufficient to furnish power to supply current for light and street railway power. Had this meeting

been called at this time there would have been no such cause for a postponement. There does exist, however, a far more serious reason why a postponement would have been desirable and in fact necessary. You are all familiar with the terrible calamity to which I refer. Everyone is inquiring for the cause of the failure of the Austin dam. Was it defective construction, or faulty design, or error in judgment as to the sustaining power of natural material, or its ability to withstand the effects of the water under the new conditions? That there has been an error committed is beyond doubt, and it is to be hoped that a thorough and impartial investigation will develop the cause of the calamity and that the responsibility may be fixed where it belongs. This is due to the men who were in any way connected with the promotion, design, execution or management of this work. The failure of this dam is of interest to the engineer from a technical standpoint: To the gas man, because it was in direct competition with a gas plant for light and power; to the electric light and street railway man, because of the extremely low rate made in Austin by this plant for current for both light and power, for its moral effect reaches far beyond the confines of Travis county; to the political economist, because it is a municipal enterprise and perhaps of a magnitude far greater, for the size of the city, than has ever been attempted before in this country.

The question has been asked, "Has the plant paid? Has it earned sufficient revenue to warrant the million and a-half investment?"

Electrolysis or electro chemical deterioration of underground metallic construction is a matter that gravely concerns the gas man and the street railway man. How to avoid damage to the mains from stray ground currents does engage the attention of the gas man, and how to avoid damages through the courts for damages accrued to gas, water and telephone mains should engage the attention of the electrician. The electrical associations have discussed this subject, the gas associations have done the same, and the street railway associations have given it consideration. It occurs to me that our Association is in a particularly fortunate position to consider it, and a paper will be contributed thereon.

History is always of value, and the one who devotes energy and time to the compilation of historical facts is a benefactor who will always be recognized as such by those interested in the particular subject chronicled. Papers of this kind should be compiled at intervals, not with a view to covering new ground only, but even to again review what has already been treated of. History will show what has been successful or unsuccessful or both, and the probable cause, and it is often worth as much to know what cannot be done as what can be accomplished.

Meters as a subject for a paper will be interesting to us all, for the time is rapidly approaching when all service must be charged for by units, and as the gas meter problem has been solved, so far as a correct and practicable meter is concerned (charlatans to the contrary notwithstanding), our paper will concern electric meters. The time for differentiation of service and revenue is at hand, and this cannot be done o any but a meter basis.

The relation of corporations to the public should engage our constant attention, and a paper will be presented on that subject which, in its text and discussion, should bring lasting benefit to all. It is a live subject and one that has but recently been prominently brought before the public through attempted legislation of a special session of the State Legislature. In this connection let me call your attention to the fact that there is practically no criminal proceeding available for the protection of our business against the surreptitious user of gas or electric current. Under the criminal code the value of the thing stolen must be proven to obtain a conviction. The thief who steals gas or electric current does not use a meter, and would hardly testify as a prosecuting witness and himself the defendant, so that it is impossible to convict for such theft, though the criminal be apprehended red-handed in the act. Of course civil action can be resorted to, but such action against one who was slick enough to rob the gas or electric company could hardly be expected to result in financial gain. I therefore recommend that a committee be appointed to prepare a bill covering this defect, which bill they will have introduced at the next session of the Legislature.

Electric wiring has been the cause of many fires in the past year, and this source of danger is steadily increasing with the more extended use of electricity. All electric wiring men are not fully aware of the dangers lurking about given conditions, nor are all gas fitters alive to this danger. It is, therefore, necessary that thorough inspection of both gas piping and electric wiring should be made, not only on what is known as construction work but also on all extensions. I might add that more thorough inspection should be made, and perhaps in some cases more competent inspectors should be employed. It is not sufficient that electric wires and gas pipes alone should receive all the attention, but also burglar alarm and telephone wires; in fact any kind of house fittings by which electric currents may be grounded, such as heating, water and sewer pipes. To illustrate, I have in mind more than one instance where solid copper wire had been inserted in the main fuse block of building instead of the proper fuse wire resulting in destructive fires. Such practice is criminal, and some method of reaching such acts should be devised. So long as any one calling himself an electrician can, regardless of his qualifications or responsibility, do work in this line, results of this nature may be looked for. Would it not be conducive to better results and to greater safety for life and property if electric wiring men were required to give bond for proper work and prompt report for inspection the same as plumbers and gas fitters are required to do. Plumbers' bonds are required as a sanitary measure as well as protection to the water works. All sanitary regulation is for the protection of health and comfort, and certainly the suggested regulation concerning electric wiring will find as much warrant in the protection of life and property.

All of the papers have been selected with a view to having subjects that will prove of general interest to all, and yet that each in its turn may have special bearing on one of the specific industries represented.

It is our desire that this Association should have in its membership not only representatives from the Southwestern States and Territories but also from the States of the Republic of Mexico, and I regret to note that there are not more here from the Republic. We welcome such as have come, and hope that they may find so much of interest and pleasure that they will be with us regularly in the future; and we hope that, as the class of industries we represet increases in importance in the Republic, the attendance at our meetings may find an increasing number each year.

For the gas interest let me say that while there are only 13 companies operating gas plants in the state, there are in the neighborhood of 300 central station electrical plants, and should comparisons be attempted, remember that a fair proportion will be at least 25 electrical men to one gas man. The gas men are always ready to do their share of the work, and will generally be found willing to keep up their end of the conversation.

To the electric light men: Let me admonish you to abandon the flat rate evil and get on a meter basis.

The street railways we all patronize, and I would suggest for your consideration a resolution, offered by a Dallas alderman, that where the street car companies refuse to keep their tracks in good repair they be required to furnish their cars with rubber tires!

The work of your various committees will speak for itself. The success of the Association is in your hands.

This is the second annual meeting, and we should gain impetus now that will carry us on for years in the work of mutual education and advancement. If you do not go away from this meeting with the feeling that you have been benefitted by these three days' association, it will have been a failure for you. Let me express the hope that such will not be the case in any instance.

Gas vs. Electricity for Lighting Purposes.

[A paper read by MR. J. R. CULLINANE, of Denison, Texas, at the Waco Meeting of the Southwestern Gas, Electric and Street Railway Association.]

I assume the above subject was assigned to me for some good reason, but I wish to assure you that I have had no experience in selling either gas or electricity in competition; on the contrary, nearly my whole experience has been in selling both articles at the same time to the same class of patrons. I will endeavor to tell you something about selling gas and electricity from this standpoint.

It is a hard matter to adjust the prices of both articles on an equal basis, and especially is this so in a small city where there is a demand for flat rates. Flat rates are a nuisance, where the company using them is also selling gas and electricity through a meter service. I will add that flat rates are very unsatisfactory. In early days I asked a promoter of electrical plants (who in those days usually represented some large manufacturer) why he asserted a 16 candle power incandescent lamp should be sold at a certain flat rate. He replied that this certain price was all we could get for it; that we must meet the prices at which we were then selling gas, and added that the demand for electricity had to be met, irrespective of its cost. Indeed, he was uncertain as to its cost. Of course we all know more now as to its cost than we did then, but I have often observed that a great many of the plants in Texas es-

tablished their prices in the same way, and probably for the same reason. The fair and equitable way to sell electricity is through meters. In the gas business the meter is used exclusively. The manager of a gas company can tell you his leakage and his yield, and exactly what it costs him per 1,000 cubic feet to make or deliver his gas; hence he can deliver his product on a basis through meters so that every foot of gas sold brings in its pro rata profit.

In the electrical business we should do the same thing. We should know our leakage and what it costs to generate and deliver the current per 1,000 watts. To do this we should measure the current as we send it out through large station meters, and then sell it exclusively through meters to our customers. All flat rates should be avoided. The investment in meters will be large, but I think the ability of the plants to sell to a larger number of customers, and thus save additional machinery, will fully repay for the investment in meters. The early prices of electricity were established to compete with the then existing prices of gas, Gas at $2 per 1,000 cubic feet was figured out equal to current at 20 cents per 1,000 watts, or 1 cent per ampere hour, and the flat rates were adjusted accordingly.

Assuming the prices of gas and electricity adjusted on an equitable basis, we will pass to the next problem, that of handling the "Dear Public." If we find any of our patrons with ideas as to the kind of light they desire to use, we encourage them in their choice. We always endeavor to let them say what kind of light they shall use without any influencing from ourselves.

Necessarily, the dual interests of a company selling gas and electricity for lighting purposes clash; but we find many places in our line of customers where only gas will serve the purpose and other places where only electricity will answer. We always take advantage of these opportunities to keep the interests from encroaching on each other, and at the same time increase the growth of each business.

In the lighting business exclusively, each kind of light has its particularly good points. In the management of a company selling gas and electricity we find other territories besides the lighting business in which to sell our products; and in these we find the dual interests do not clash.

Our sales of gas for cooking purposes in no way affect or decrease our sales of electricity. To a dual company this is a wide field—40 per cent. of our gas is sold to this class of business, and the percentage is always growing. I can remember only a few years back when gas companies had only a small part of their output going through gas stoves. We have another large field for the sale of gas through the medium of the instantaneous water heater. This apparatus has reached a very high state of mechanical perfection, and the demand for it is growing. They are very satisfactory to the patrons of a gas company, and are also very satisfactory to the gas companies themselves.

By pushing the sale of gas in these two fields, we do nothing to harm our electrical business. The advent of the Welsbach burner brought joy to the gas man, but the Welsbach burner is in direct competition with electricity, and it is not my purpose here to discuss that side of the question.

As stated above I will endeavor to show you that there are spots in the dual business that are not necessarily competitive.

I have stated a few of the fields in the gas business that can be pushed without harming the electrical business. On the other hand, in the field of electricity, we have a class of business that can be pushed that will not interfere with sales of gas. I have reference to the sale of current for use in small motors and fans. This is a very wide field and a very profitable one. The prices usually paid for power current are more renumerative than those paid for lighting purposes.

Nearly any electrical company can operate a power circuit successfully and profitably. The number of places that will use motors and fans is astonishing. To a company doing a dual business this class of trade is of large assistance. Another field for selling current is in the way of advertising. You will find many customers willing to spend money for electricity in different ways in advertising their business. Some will use arc lights or incandescent lights or both for illuminating the outside of their stores and show windows and others working electrical devices and signs to attract attention to their stores. This is not in competition with the sale of gas, and brings in quite a nice return.

Further, by combining the businesses, if you can control the territory and avoid the awful prices usual where competitive plants exist, there is a hope for success. I am frank to say I often wonder how some of the competitive plants exist and sell their products at their prices. I think good management should mean good prices, but I don't understand how some of these competing plants can pay actual operating expenses, to say nothing of fixed charges, interest, depreciation and repairs. I assume they know their business and are pleased with the results. Any way, one set of people are happy where there is competition in the lighting business, and that set are my friends, the "Dear Public."

Operation of Electric Lighting Plants from a Business Standpoint.

[A paper read by MR. A. E. JUDGE, of Tyler, Texas, before the Waco Meeting of the Southwestern Gas, Electric and Street Railway Association.]

Assuming that we have a market which comes largely from natural causes, and that capital is available for the enterprise, a most essential prerequisite of success is judgment, for, "Men's judgments are parcel of their fortunes." Judgment may be defined as commonsense, that quality of mind which distinguishes the essential from the non-essential. "He who possesses this quality has a command of resources and the same advantage over men of any other qualification whatsoever as one who can see would have over a blind man of ten times his strength."

Intelligence and judgment, however, can never take the place of experience, which comes from effort, worry, trial, and work. "Experience is a dear school, which to most men is like the stern light of a ship, illuminating only the track that is passed." The manager of judgment secures expert advice and avails himself of accumulated experience.

He should intelligently study the men under him and employ those who are trustworthy and capable of performing well the specific duties assigned to them. Every kind of work has a science belonging exclusively to itself, a science which is learned by experience and observation. A man may be very efficient in one line of work and inefficient in another. For instance, he may be a good accountant, collector, or canvasser, but a very poor mechanic or electrician, or vice versa. "Expert service for each duty is the rule of success in large industrial organizations."

In very small establishments it is true that the manager must be a man of untiring industry and varid accomplishments, and has to perform many kinds of duty. The success of a small plant depends largely on industry and attention to small savings: "In saving the pennies and letting the dollars take care of themselves." But in a larger establishment the manager should should not be expected to do routine work. It is his business to keep himself posted and to have a clear and comprehensive understanding of the main factors of the business, actual and prospective, and to see that these factors are worked out and produce the right business result. And yet he should have and know that the detail and routine work of the business are properly done.

The manager of a public service industry has a great deal of prejudice to contend with. He should be a man of broad views and possessed of those personal qualities which will command the respect and confidence of the community.

Insurance Against Accident and Stoppage.—The best insurance of a station against fire is to make it fireproof, or as nearly so as practicable. This can often be done by putting in a hydraulic cement floor, having the walls of brick or stone, with a metal roof. If the station is only partially fireproof, it should be provided with means of fire protection, such as automatic fire extinguishers, which should be kept in working order, ample service pipe connection with the city water mains, with pressure pump and fire hose, automatic sprinklers, steam pipe connection from boiler to engine and dynamo room, so that it can be filled with steam if necessary, etc.

Prevention of fire instead of collection of insurance is what is needed, as no insurance company will make good the loss of business occasioned by a stoppage to rebuild a plant after it has been burned down. Reserve boiler, engine and dynamo capacity should be provided (where there is sufficient capital) for provision against temporary stoppage. Extra boxes should be kept on hand for the bearings of engines and dynamos; also extra armatures and materials for repairing. Arrangements of pulley blocks, trucks and apparatus, to facilitate easy and rapid handling of armatures and machinery, should be installed. Every reasonable precaution should be taken against accident from boiler explosion and from persons coming in contact with live wires charged with current of high tension. Boiler insurance is cheap, and the periodical inspection by the insurance company's men is a safeguard.

Electrical indemnity insurance is much higher than boiler insurance, and a number of managers are opposed to carrying it, but electrical

risk is a danger that should be provided against in some sufficient way. As prevention is better than cure, the insulation on the lines should be kept up to a safe standard. An ample supply of fuel should be kept in stock to provide against stoppage of supply from flood, strike or other cause.

Accounts, Instruments and Records.—Andrew Carnegie said in one of his addresses: "There is not a science or a class of men on whom the business world is more dependent than the science of accounts and accountants."

A comprehensive set of accounts should be so kept that the condition of the business can at all times, with the least labor, be accurately ascertained, and that fluctuations in its details may be readily known.

Suitable instruments and meters should be provided for testing and showing the workings of the equipment, and suitable records should be kept for comparison.

Education of Employees.—Employees should be encouraged to become thorough. Technical books and papers should be provided for their use. Those who are superficial will be content with the routine that has to do with their daily work. The workman who is thorough is discontented unless he is always learning. He should be encouraged and promoted when vacancies occur in such positions as he is fitted for.

Street Lighting and Other Income.—Until the streets are well lighted, earnest effort should be persistently directed to acquaint the people and city authorities with the true economic value of well-distributed street lights to be burned all night, of which Mr. Allen R. Foote has written: "Street lights are a protection as well as a convenience. The quality of protection increases in value as that of convenience decreases. From dark until midnight the lights are most valuable as a convenience. During those hours there are many people on the streets. The number gradually decreases as the night advances. The more people there are in the streets, the less is the need of protection, for there is mutual protection in their presence. As the number decreases, the value of the light changes from that of a convenience to that of a protection. * * * So well is this value of protection understood in large cities, it is frequently urged as the only consideration for placing lights in certain positions and for increasing their number. * * * It is ridiculous to employ a policeman to stay on the streets, and then limit his power of observation to the lantern he may carry in his hand."

Foote says that usually a lighting company gets about one-sixth of its entire income from lighting the streets, and that, in cities of the first class, about 60 cents per inhabitant per annum is paid for such lighting.

Of course commercial and residence lighting afford the principal sources of income and should be fully developed. Customers wants should be studied and supplied as satisfactorily as possible. Consumers should be taught to economically use our product, through the newspapers, by display of appliances, by personal explanation, and otherwise. The liberal use of light should be encouraged where customers can profit by it. Teach them the advantages of having incandescent lights close to their work and properly located, the use of shades, reflectors, frosted lamps, extension cords, adjusters, portables and floor stands. Teach them to economize on light by not using it when and where it is unnecessary; that in closets, back halls, and similar places, two and four candle power lights are usually sufficient and that large lights may be reserved for places where bright lights are required. Explain to them that, for same nominal candle power, new lamps are brighter than old ones, and that in residences, when lamps are renewed, by moving old lamps from the sockets where brightest lights are required to other parts of the house and substituting the new ones in their places, the brightest lights will always be where most needed. Effort should be made to popularize the light and to extend sales by studying and protecting your customers' interests, for a satisfied customer is the best advertisement.

Expenses.—They should be kept as low as practicable, consistent with efficiency. Suitably selected labor should be employed at fair wages and its energy should be well directed. Through tests, records and other sources, the management should learn the efficiency of the different fuels, materials and supplies in the market, which, all things considered, will be bought at the lowest market price. Inefficient machines, equipment, converters and meters will be found and so repaired as to make them economically efficient, or they will be replaced by others that are so.

Prices.—The prices should be such that the sales will pay cost of production plus a reasonable profit. It should be borne in mind that certain expenses or fixed charges remain practically the same per annum for each particular plant, irrespective of the quantity of the output, such as interest on the entire capital, taxes on tangible property, insurance against accident, insurance against impairment of capital (including depreciation on plant and machinery through the progress of invention tending to displace that in use and through other causes). The greater portion of operating expenses is more nearly proportional to the quantity of output. The output in any particular locality is limited by the local demand that can be developed.

Prices must be sufficient for each particular plant to afford an income in excess of operating expenses to pay its fixed charges plus a profit. If this cannot be done the industry for that particular place must cease to exist.

Social Fallacies.—The politics of a community depend largely on what the people deem to be to their immediate self-interest. For instance: Manufacturing communities in the United States have usually favored a protective tariff, while exclusively farming communities have been for free trade or for a tariff for revenue only, and socialism is popular where the citizens have but little invested in property. When the capital of the citizens shall be largely invested in developing the resources of this section and in local manufacture, which has already commenced, we may expect a more healthful attitude towards private corporations. In the mean time we may do much to correct popular social fallacies through the dissemination of sound economic literature, and by other means. We should help to develop in the community a knowledge of its true economic relation to invested capital in general and to public service industries in particular. It is useless to try to educate politicians, for they love office more than truth. So soon as the people know their own interests the politicians will fall into line.

Our Industry.—In conclusion, the industry which we represent is one of which we may be justly proud. Draper, in his "Intellectual Development of Europe," says of artificial lighting: "It has extended the available term of man's life by giving the night to his use. It has, by the social intercourse it encourages, polished his manners and refined his tastes, perhaps as much as anything else has aided in his intellectual progress."

The Attitude of Municipal Corporations to the Public.

[A paper read by Mr. JOHN G. BOYD, of Terrell, Texas, at the Waco Meeting of the Southwestern Gas, Electric and Street Railway Association.]

Mr. President and Members of the Association:

In the opinion of the writer, your assignment of a topic for consideration by the members at this session is a subject most difficult of treatment by persons who, from their prominence or versatility, are in a position to rattle off a treatise at so much per "treat," line or column; hence when you elect to substitute one so lacking in these essentials as the writer for one possessing those peculiar attributes, you have no right to expect anything less than an utter disappointment.

In scope and application, this topic is of almost limitless proportions. Circumstances and conditions which might apply with forceful effect in some instances may not permit of serious consideration in others; furthermore, in the main, would not the "attitude" be a matter of individual opinion?

When we go before a municipal corporation and ask franchise privileges, and the municipal corporation grant our request in its entirety as desired, we are inclined to feel that their attitude is most gracious and just; but, when they mulct us out of several per cent. of our gross earnings, in the way of free services or a certain per cent. of gross earnings as a condition precedent to the granting of such franchise rights, it is believed to be an embodiment of human nature to strongly condemn "The Attitude of Municipal Corporations to the Public."

In a paper, read before the League of American Municipalities, at Syracuse, New York, last September, Hon. H. V. Johnson, Mayor of Denver, Colorado, opened his paper with these remarks: "The question under discussion, like all others the human race has solved, must pass through the crucible of investigation. It must stand the test of criticism and opposition. It must pass through the fire of actual trial and experience. Unless, like the pure gold, it comes forth brighter and unharmed, it is sure, sooner or later, to be relegated to that vast graveyard prepared for those things which the human family have 'tried and found wanting.'"

While the foregoing extract applied particularly to public industries and their municipal ownership, your writer feels that it applies with equal force and effect to this topic. It is also believed that this subject naturally leads one up to the question, "Shall the city own and operate, for the convenience of its people, water works, gas, electric light, street railway, and telephone plants?" That the municipality

can, as a rule under the law, undertake the business of furnishing these latter day necessities to its inhabitants is beyond the pale of doubt or question. It has been possitively and finally settled, both by the State and federal courts, that the city has such authority, yet no amount of legislation possible can of itself result in the proper economic operation of either or all of these industries. It not infrequently happens that the sole consideration advanced by an applicant for the position of general superintendent of municipal industries is a "political pull" with the majority of the executive board, or services rendered at the polls. Where such a condition exists it is folly to expect satisfactory results, and in those cases "The Attitude of Municipal Corporations to the Public" is far from satisfactory, for it is confidently believed that in many cases of municipal failure, a private company would not only have been successful from a dividend standpoint but would have also afforded the public satisfactory services. It hardly seems fair or just to presume that in the generality of cases the municipal body is lacking in the possession of at least one or more enterprising business men, hence were that faction to look after the public trust with the same care and close attention to all details that they give their commercial enterprises success all along the line would be the natural result. The stern school of experience, however, has demonstrated time and again that, while men of such stamp mean to bestow the same care, time, and attention upon municipal matters that they do on their own commercial enterprises, they are debarred from so doing by the lack of necessary time or balked by a designing ward heeler.

In several instances the writer, when selling and erecting electric light plants throughout the country, was asked his opinion of the feasibility and desirability of municipal ownership, he seldom had but one reply to make to the query, and that was this, "Do you, sir, realize when you cast your vote for municipal ownership that you have, in effect, mortgaged your property by the proposed issue of bonds from the sale of which is to be derived the funds to create such an enterprise by virtue of the fact that you will have to pay interest on those bonds and provide a sinking fund for their final payment?" Of course, many of the voters are not property owners and are disinterested in that phase of the question, but usually they are in the minority. We all of us understand how the disciple of municipal ownership, in his presentation of the so called merits of his scheme, is want to "paint the lily and throw a perfume o'er the violet." He represents to them how municipal ownership will reduce the cost of these commodities and the undertaking is entered upon with enthusiasm. In the first few years, or during the period of dress parade conditions, the showing and the balance sheet certainly appear attractive. Then, as extraordinary repairs become necessary, there at once becomes apparent the direct result of political preferment in the selection of a Major Domo; and the negative era is entered upon with the advancement of many natural reasons therefor. Here is where the non-property owner commences to pay the fiddler for his dance, earned through the ballot box with his bond voting ballot in his hand; and, inasmuch as his income is naturally quite limited in the end, he suffers the most, for the longer the industry is operated the harder he is bit by increased taxes.

A gentleman named Wisner, commenting on public ownership in Toledo, O., said: "Toledo is a city of nearly 150,000 inhabitants, equal in intelligence and enterprise to any similar community in the world. It is a city of beautiful homes and thriving industries, the second railway center in the world, and situated to command a large share of the commerce of the unsalted seas. In no other city in this country are the masses better clothed, better fed and better housed.

"Toledo has had some experience in owning public industries, and the balance sheet is interesting reading. She built what is known as the Woodville Railroad—it cost the city $448,000—and the city sold it to the Pennsylvania Railroad Company for $225,000—leaving a red ink balance of $223,000. The city borrowed $232,000 of the original cost and gave her bonds bearing 7.3 per cent. interest, payable in 30 years. The bonds will become due this year. When due, the city will have paid $946,080 in interest, and the principal will have to be carried along until the present generation shall have bequeathed to posterity both the debt and municipal problem.

"The city borrowed $1,500,000 to go into the natural gas business. This enterprise has paid $100,000 gross to the city, but not one cent of interest, which is running at the rate of $67,500 per annum. By the time the natural gas bonds are due, the city will have paid over one-half million dollars in interest on the earnings of $100,000 received, and will leave the taxpayers burdened with an additional debt of one and a half millions. The city has recently refused a cash offer of $256,000 for it, and has entered into a contract with a New York syndicate for the manufacture of fuel gas to supplement the natural gas supply. It is only fair to state that the advocates of the municipal ownership excuse this failure on the ground that the natural gas supply became exhausted, or nearly so, a disaster which no foresight could provide against. It should also be stated that a competitor under private ownership in the same field has made the business profitable and is still paying dividends. Toledo also owns its own water works. Financially this has been a fair success and affords a great contrast to Toledo's other business investments. Its service, however, is not such as would be tolerated were it conducted by a private corporation."

We, of course, all know that the United States post office department exemplifies a most striking example of public ownership, and with the U. S. treasury behind it, it is enabled to continue business at the old stand 365 days in the year, but at an average daily deficit to the taxpayers of the United States of between $40,000 and $50,000, notwithstanding many of the items figuring in the balance sheet of a private corporation are omitted from the government's annual reports, which, were they included, would probably raise the daily net deficit to $70,000 or $75,000.

Mr. M. J. Francisco, in 1895, stated, in a publication called "Municipal Ownership—Its Fallacy," that the following municipalities have seen their mistake and sold their lighting plants: Greenville, S. C.; Carrollton, Ga.; Stockton, Kan.; Lyons, Ia.; Marceline, Mo.; Marietta, O.; Michigan City, Ind.; Portland, Ore.; Tipton, Ia; Titusville, Pa.; Moline, Ills., etc. The city of Cincinnati furnishes a most notable instance of the fallacy of municipal ownership of industrial undertakings by the sinking fund trustees of that city having accepted a bid of $19,000,000 for the sale of the Cincinnati Southern Railway."

St. Louis a few years ago furnished an example of the "attitude" in the erection of the new City Hall. The writer was one of a party escorting a body of visiting engineers through the building, which the residents of St. Louis looked upon as a most gigantic misfit and monstrosity. One of the visiting gentlemen, who, by the-way, was expected to roast the very life out of the conglomerated pile, to the surprise of everyone, was most loud in his praises of its many artistic features (?) and the balance of the party thought he had gone daft. When the time came to again enter the carriages for a continuation of sight-seeing, that gentlemen bade the driver hold up a moment for one last, lingering look, and, after studying the exterior of the building a few moments longer, and in response to a question he exclaimed, "And the worst of it is the damned thing is fireproof."

The *Western Electrician*, of March 24, 1900, publishes a synopsis of the report submitted by Mr. E. B. Ellicott, City Electrician of the City of Chicago, wherein that gentlemen gives the annual cost of arc lighting as being $55.95 per lamp year, and, in editorial comment on these figures, the editors of that paper published additional omitted factors which evidence the annual cost of production is not one cent less than $90 98, and opine that careful analysis will tend to increase rather than diminish that cost.

A few years ago the Detroit, Mich., municipal plant was held up as a monument of economic administration, and the cost of production was juggled so as to show the cost per lamp-year to be $84 96, being some $48.36 lower than the preceding private contract, yet Mr. James I. Ayer, ex-President of the National Electric Light Association, together with other respected authorities, easily proved the actual cost of production to have exceeded the private contract price.

The *Mining Journal*, of Marquette, Mich., sometime ago stated: "The *Mining Journal* has been a consistent and persistent advocate of municipal ownership of water supply and lighting systems. It has maintained that, with proper management, plants for supplying water and light to urban communities could be depended upon to render a better and cheaper service, when owned and operated by the communities thus served, than is ordinarily rendered by corporations or firms giving the service under a franchise. But it begins to have some doubts of the soundness of its position in the matter, these being raised by the history of the attempt made in this city to furnish public and private lighting from the electrical plant on the city's Dead river property. Since its installment, Marquette's lighting plant has been in evidence all over the country as an example of the advantages the people derive from owning and operating their own lighting plants; but there is reason to believe that it will no longer be so cited and regarded. It surely cannot be if the kind of management the plant has had during the past year is continued. And suppose a change is made, and a board is given charge of the plant that will remedy the blunders of the present board, what assurance have we that some future council will not take steps to legislate the board out of control which does this, and again place it under a management that will squander its earnings and impair its serviceableness?"

Continuing the subject, that *Journal* says: "A gentleman from Escanaba informs us that, in order to make a good showing for the action of purchasing an electric light plant, they turn off their lights at midnight to save expense, and only run the lights on dark nights, while the electric light company here runs the plant all night and every night, dark or not, and this when there are only 20 lights in the streets." After reciting numerous items of gross depreciation, this follows: "The facts here set forth are enough to raise doubts as to the wisdom of having municipalities undertake to render service of this kind in the hope of obtaining enduring good results. Certainly if the Marquette plant proves a failure, through the interference of a stupid council to start with, and the management of the board dominated by a single member whose most conspicuous characteristics are unbounded confidence in his own judgment and a mulish obstinacy subsequently, there is little use of expecting anything better from municipal ownership and operation of such plants in places where the economic conditions are less favorable, for with the plant here the power costs nothing, whilst with a plant operated by steam the power costs heavily.

To get a little nearer home with an illustration of "The Attitude of Municipal Corporations to the Public," we can dwell a moment over the gigantic municipal investment at Austin. Whilst the writer was not a resident of your State during the "pioneer period" thereof, he distinctly remembers reading in the papers about the "Coming Moses" which was to rescue Austin from the slough of despond, and at one grand stroke place her on the topmost pinnacle of fame. She has obtained the fame all right, but is practically bankrupt, or expects to be, according to statements appearing from time to time in the local papers. There is hardly room for doubting but what the monthly balance sheet shows a red ink balance on the wrong side of the ledger of some $8,000, and that the tax rate has been increased over 150 per cent.; but she has a municipal plant all right, and if she can possibly raise the necessary funds she is likely to increase her hold in a supplementary investment designed to discount the annual rainfall. If successful in raising the proposed funds she will have a little more municipal plant than she now possesses. As her line of credit has already been extended far beyond good financiering practice, it is not altogether apparent where the money is to come from. Texas bankers and financiers with whom the writer has conversed on the matter seem to feel that it is only a question of a short time ere the City of Austin will become bankrupt through this monumental example of the "Attitude of Municipal Corporations to the Public."

January 17, 1896, the City of Utica, New York, appointed a committee to investigate and report on the matter of erecting a municipal lighting plant, and, in submitting that report, and after reciting in detail the items of cost of production that committee said, in part: "We, in view of the facts above stated, believe that the hope held out to us by Mr. Roberts, of obtaining an electric lighting of this city at a cost of $80 per lamp year under a system of municipal control, as vouched for and recommended by the Trades' Assembly of this City, can never be realized. Upon the contrary we believe that any system of municipal control that might be adopted, with the most efficient, economical and honest management, would very nearly approximate to, if not exceed, the maximum figures herein before stated, viz., $127.70.

The same report evidenced that, of a total of 8 municipal plants from which figures had been obtained, with Chicago as the largest, and Hannibal, Mo., the smallest, the average candle power given for one cent was 476, and, from 9 plants privately operated, St. Louis, Mo., included as the largest, and Galesburg, Ill., as being probably the smallest, the candle power for one cent was 720.

Gentlemen, it hardly seems necessary to longer continue this exhibit, which has been carefully culled from various publications, and the result seems to indicate that, if the examples herein given are to be adopted as a fair average of existing conditions, it is hard to understand how the result can be otherwise than disastrous through the manifest "Attitude of Municipal Corporations to the Public."

Electrolysis.

[A paper read by Mr. E. H. Jenkins, of San Antonio, Texas, at the Waco Meeting of the Southwestern Gas, Electric and Street Railway Association.]

During the past nine or ten years, the subject of electrolysis has been a very important one to those companies who are compelled to carry on their business through the use of underground conduits or conductors, such as gas pipes, water pipes, telephone conduits, etc., and the great amount of damage occasioned by the action of the electric currents upon these underground pipes, etc., has caused quite a number of experiments to be made and a number of investigations to be carried on in order to determine the cause and provide, if possible, a remedy for the evil.

Electrolysis is described by a recent writer as follow: "In contact with gas pipe, water pipe, telephone tubes, etc., is the soil, containing and electrolyzable salt chloride, nitrate or sulphate of ammonia, potash, soda or magnesia, generally. In the presence of moisture this soil becomes an electrolyte or salt solution. In the absence of electricity no appreciable damage occurs, but the passage of an electric current, no matter how small, from one pipe to another is sure, sooner or later, to leave its trace upon the positive conductor in the form of a decay other than mere oxidation. It is this decay that has been given the name of 'electrolysis'; so that when this heading appears in the daily press or in technical journals, one may interpret the term popularly, as the electrolytic corrosion of metal buried in the soil." At first it was thought that the damage to gas and water pipe was caused by the electric current as it passed *to* them, but experiments soon proved the fact that it was at the point where the electricity passed *from* the pipes that damage occured. There is scarcely any doubt now but that electrolysis in a mild form existed for several years before the introduction of the trolley systems, for before that time the telephone and telegraph systems used the earth for the return circuit of their systems, and the "vagrant" electricity from these systems used the water and gas pipes where convenient for the return current. That there was damage from this cause fully accounts for the destruction of small service pipes in the past where the soil did not contain any substance as far as could be ascertained that would produce corrosion.

It has been established in experiment by a number of investigators that it needs but an extremely low potential, not exceeding one-hundredth of a volt, coupled with other favorable conditions, to produce electrolytic action, though it may take considerable time to cause the results to become apparent. It is evident, therefore, that electrolysis to a limited extent has taken place in the larger cities for a number of years, and the large increase in volume of electricity used for various purposes in the past ten years has simply made the results more apparent and the action more rapid. The rapid increase in volume of electricity used is due to a large extent to the trolley system of street railroads. The electric current used for the propulsion of the trolley car is carried from the power station, usually by an overhead system of copper wire, the current being supplied to the motors of the several cars by suitable trolley pole and wire connection; and it is necessary after the electricity has been used to drive the motors that some provision be made to return it to the generators at the power station. Following upon the use by the telegraph and telephone companies of the earth as a return for their current, the same principle was adopted by the first trolley car systems—that is, the current was carried from the motors, via the wheels to the rails, and the latter were used to return the current to the station. Little or no provision was made for the current to pass from the end of one rail to the next rail in line, and, as a consequence, large quantities of the current, would escape from these points, and, finding an easier path, would enter the earth, collecting on gas or water pipes that might provide an easy means of return towards the power station. In the first installation of trolley systems, in many cases the old rails of horse car systems were still used, and in others 35 or 40 pound rails only were used, and these, with the poor attempts at connecting the ends of the rails together, did not provide a sufficient or convenient return for the electric current. It took time and experience to demonstrate the evil effects produced by the electric current that escaped to the earth under the circumstances stated above. As a result the electric railroad systems established in the past few years have made better provisions for taking care of the return current, and I believe that little or no damage is possible from systems that have rails of ample capacity properly bonded with copper bonds sufficient to carry the volume of current to be returned. It is not necessary to have a copper bond of equal capacity as the rails, for, as in the case of the 80 or 90 pound rail of to-day, the carrying capacity of the rail is many times greater than the volume of current that is returning. I am aware, however, that a number of electrical engineers do not agree with the proposition that heavier rails, more and larger return feeders and better bonding would prove a remedy for electrolysis. In a recent article in Appleton's *Popular Science Monthly* (January, 1900), upon "The Destructive Effects of Vagrant Electricity," Mr. Hubert S. Wynkoop, M. E., writes as follows: "I am of the opinion that it is impossible from a financial standpoint to provide so satisfactory a legitimate return that considerable electricity will not seek a path through pipes, cable covers, etc., for, in order to confine the electric current to rails, the resistance of the

earth and its contained pipes would have to be infinitely great, and this condition can only be realized by making the resistance of the rail infinitely small as compared with that of the earth. The cost of arriving at this condition is prohibitive, and the improved track return is, and always must be, a palliative merely, not a cure."

Mr. I. H. Farnham, of the New England Telephone Company, of Boston, was the first to carefully investigate the electrolytic action of street railway current and its effects upon underground structures. A study of the electrical earth conditions was carried on in Boston during 1893, the result of which has yielded much valuable data in regard to this problem, and numerous experiments of Mr. Farnham have afforded valuable information as to methods of mitigation. Usually the first effect of parasitic currents is noted upon water pipes and telephone cables. The sheaths of telephone cables and the house service pipes being of lead usually succumb more quickly than the larger and heavier gas and water mains. It was supposed at first that the corrosive action which developed was a natural consequence due to the moisture of the earth, and the pipes indicating defects were replaced but failed again within a month or two. Larger and heavier pipes were substituted, but it was not until the difficulty became extensive that the suspicion was entertained that the street railway current was the culprit in question, and experiments instituted that unerringly located the difficulty. The first attempt at correction was the reversal of the polarity of the railway station dynamo, placing the positive pole to the trolley wire. This was succeeded by a more careful and thorough bonding of the rail return in an endeavor to improve this part of the railway circuit.

At the 1894 meeting of the Western Gas Association, the Committee on Electrolysis, through its Chairman, Mr. George Treadway Thompson, made quite an elaborate report,[1] from which I quote as follows:

"Coming now to a consideration of the remedies, we will first notice those which have been suggested for adoption by the gas and water companies. Probably the earliest of these was that of coating the pipes with non-conducting paint or a covering of similar purpose. A parallel of this is the use of drain pipes of slightly greater diameter than the metal ones, slipped over the latter and cemented at the joints and ends. These have been adopted with especial convenience for service pipes crossing under the rails, but their value is dependent upon the local circumstances. If the corrosion of such a place is caused by the current flowing downward through the earth, and so entering and leaving the service at about the same points—placing it in an electric bath, as it were—such a covering should prove a true protection. But if the current had reached the line through some imperfection at a point further away, and caused the corrosion by leaving the pipe to return to the rail, any insulation, if locally effective, would cause the current to seek a different avenue of exit and so merely transfer the point of corrosion. A determination at such places of the direction of the current, whether from or to the rail, would show whether or not a non-conducting covering would be effective. Incidentally, the adoption of insulation at the current's point of departure would increase the resistance of the mains and so decrease the proportion of current carried, but complete relief by the plan suggested would require encasing of the entire distributing system, and as a final curative it may be dismissed as impracticable. The same reasoning applies to the method adopted on certain lines of water pipes in Los Angeles, which were laid in conduits filled with sawdust, and also to the use which has elsewhere been made of a covering of pitch, kept in place by boxing of convenient form. All these protectives are too costly for general adoption, and no partial installation of any of them would wholly cure the trouble. A similar statement may be made regarding the device of winding or protecting the pipes with copper wires attached to plates buried below. This was tried in Cambridge, Mass., but relinquished because of the rapid destruction of the copper ground plates."

Mr. I. H. Farnham gives the following description of still another plan, in a recent paper before the Institute of Electrical Engineers: "Prof. Elihu Thomson suggested placing motor generators along the railway line wherever the cables and pipes are found to be in danger, to be operated by the railway power current; the secondary current developed by these generators to be utilized to lower the potential in the cable and pipes to zero with respect to the surrounding earth and rails. The suggestion included means for automatically starting and stopping the generators, as cables might become positive or negative to the rails. The motor generators would, so to speak, pump the current out of the cables and force it into the rails whenever the potential of the former should rise above zero. This plan has not yet been put into operation so far as I am aware."

1. See JOURNAL, May 28, 1894, p. 765.

A system which many large roads are now adopting as a means of decreasing their current leakage is that of using insulated track feeders designed to carry the entire current, joined to the rails at short intervals, each 400 or 500 feet for instance. The rails are thus employed as conductors only between the feeder junctions, and the liability of leaking currents is very much reduced. The system is certainly a step in advance of anything we have yet considered, and having been adopted in Boston, Brooklyn, Cleveland, etc., we should soon hear if by its use destruction of the pipes is wholly avoided.

In a pamphlet (No. 5) issued from the Electrical Bureau of the National Board of Fire Underwriters, Messrs. Stone and Webster, electrical experts, of Boston, Mass., say: "Experiments have shown that where corrosion occurs at the places where the current leaves the buried metal for the earth, there is a tendency for the metal to go to the negative pole of the generator, just as in a plating battery the metal attached to the positive pole is deposited on the object attached to the negative pole. If the current can be kept from flowing into the buried metal, or if it can be prevented from flowing into the earth from the metal, the corrosion can be stopped. But the return current of an electric railway divides among the different paths back to the station in proportion to the conductivity of those paths, and a large proportion of the current often returns through pipes, etc., because the conductivity of that path is comparable with the conductivity of the regular return circuit through rails, return wires, etc. To get rid of electrolytic action, it is consequently necessary either to make the regular return circuit of such low resistance that there will be no flow in the pipes, which is practically impossible, or so to arrange return feeders that the current will not leave the pipes for the earth."

Quoting from the same pamphlet, Messrs. Pierce and Richardson make the following statement: "The direction and amount of stray current depend not only upon the arrangement and proportion of the underground conductors, but upon the arrangement of the pipes, the conductivity of the soil, etc., and also upon the distribution of the current upon the railway system, which in turn is dependent upon the number of cars, frequency at which they run and the amount of current required to operate them. The problem, therefore, as we stated before, is too complicated to solve in any case except by making a study of the local conditions. This study should be made both when the road is designed and after it is in operation, and as the conditions which cause electrolysis are constantly varying every road presents a problem for constant study to those operating it."

The following is a report made to the American Railway Association by Mr. T. J. McTighe, for the Committee on the Return Circuit of Electric Railways: "I am, therefore, led to the conclusion that the best return circuit is that which complies with the following requirements:

"1. Intrinsic resistance low enough to need no help from earth.

"2. Utilization, to the utmost practical extent, of the rails as the return conductors.

"3. Rail bonds of the heaviest practicable size.

"4 Rails bonds of the shortest possible length consistent with due allowance for expansion and vibration.

"5. Rail bonds made of a single piece of wire with integral rivets.

"6. Rail bonds tightly riveted to the rails through holes freshly reamed immediately before bonding.

"7. Rail bonds so placed as to permit convenient inspection.

"8. Rail bonds protected against corrosion.

"9. A very liberal use of heavy cross bonds from rail to rail direct, and in double track, extra heavy cross bonds connecting the two inside rails.

"10. An underground main or trunk return from power house to track, and there connected to each line of rails and low enough in resistance to carry the maximum current with but a nominal drop in potential.

"Not one of these requirements is an extravagance, but on the contrary their proper application to almost any electric railway in the country would be of immediate and lasting benefit. In new constructions they would be a positive economy in first cost. There is not one of them which cannot be adopted in practice, and it seems obvious that their complete embodiment in any existing road would be immediately noticeable in the power house and eventually in the dividend."

In the March, 1900, number of the American *Electrician*, an article on "The Effect of Joint Resistance on Railway Electrolysis," by Mr. A. A. Knudson, of New York City, is of great interest to managers of gas and water works systems. I quote from the article as follows: "The point I would advance is one which I think has not been given the importance it deserves in the past by those who have studied this

question. I refer to the effect of joint resistance. In the case of cable sheaths, there is, of course, no fear of trouble from this cause, but with water pipes, gas pipes and Edison tubes it is ever present. I have measured a number of joints in water mains, and generally have found their resistance to be proportional to the length of time they have been in the ground. This would seem reasonable when we consider the construction of these joints.

The pipe lengths are treated with an asphalt varnish both inside and out, so that the ends, when placed together, are practically insulated from each other; when the melted lead is poured in, the varnish is not impaired at all by the heat, as has been proved by actual investigation. Furthermore (and this point has a bearing on resistance increasing with age), if the lead does touch the iron through the process of caulking, we know that lead and iron are wide apart in the galvanic scale, and that moisture ever present about water pipes furnishes the remaining element to cause galvanic action, and consequently corrosion and increase in resistance year by year. To the galvanic effect of placing together two dissimilar metals (lead and iron) must also be added the additional corrosive effect of more or less railway current passing through these joints. The effect of such resistance is to cause the current passing through such mains to leave the positive end of the pipe and pass through the earth around the joint to the end of the next length, or it may pass through the water on the inside and thereby cause damage through electrolytic pittings, or reduce the iron to a condition of graphite—which I have often seen—where it leaves the pipe, both inside and outside. So far as I am aware, Prof. Lucien I. Blake, of the University of Kansas, was the first to discover damage to the interior of pipes, at an investigation made at Kansas City. Mr. Farnham, however, mentions this possibility in his paper, where he refers to breaking the metallic continuity. He said: "In case of water pipes treated in this manner, the action might be expected on the interior as well as the exterior." This would apply as well to a high resistance joint as though it were intentionally insulated.

"This feature of joint resistance and the continual increase of such joint resistance the longer the pipes are in the ground being a well established fact, it would seem that such methods as 'independent returns' would involve conducting the railway current through the pipes are by no means the cure which some advocate. As a summary, therefore, it appears that the age of pipes is an important factor in determining the possibilities of electrolytic damage at or near the joints. It would seem, then, for an absolute cure for electrolysis there is nothing in sight except to abandon the earth, as the telephone companies had to do when the trolleys came, and resort to metallic circuits, which means double overhead or underground systems. The double overhead is, of course, the least expensive and has been in use much longer than the underground. Besides its long satisfactory use in Cincinnati, O., it has recently been installed on some of the important lines in Washington, D. C. There is but little objection to the system, and it is not unlikely that other installations will be made in other cities."

Mr. Knudson is also the author of a paper entitled "An Electrical Survey in the Borough of Manhattan, New York City," which was read before the meeting of the American Institute of Electrical Engineers, New York city, October 26th, 1898. This paper is certainly full of startling information, which would go to show that the magnificent iron structures of New York city, and especially the Elevated Railway structure and the Brooklyn Bridge, were subject to action from electrical current passing from the pillars of the Elevated Road to rails of Third Avenue Cable Road and the water pipes, showing a difference of potential of 3½ volts, and the probability that this current had been passing between these points for more than a year. Mr. Knudson says: "In the light of present knowledge on this subject the very serious question presents itself to any practical mind here present, in what condition would we expect to find the anchor bolts and iron foundations of these pillars if excavations were made at their base?

"Further tests at the New York entrance of the Brooklyn Bridge at pillars nearest the 4 loop tracks show they are negative to rails of these tracks with maximum voltage of 3½ and an estimated average of 2¼."

In a recent installation of several blocks of new rails in San Antonio we used the 74 pound Johnston rail, the rails averaging 60 feet in length. The ends of the rails were placed together as close as possible and extra heavy plates and bolts were used, and we double bonded these rails, using a Morris rail bond under the plates and a No. 0000 copper bond around each plate. The holes where these bonds joined the rails were carefully reamed so that the metal was bright, and then the end of the bond was forced into the hole with screw power. As this line of track leads from the center of our street railway system to the power house, and as we have provided suitable return cable from the rail to generator, we feel that we have provided an ample return for the system, especially as we have other rails of the system properly bonded. However, in order to make ample provision for any stray currents that may come from other sections of the city, we have also connected return wires from the gas pipes near the power station to the generator.

From the testimony gathered from various experiments made I feel satisfied that, in cities of say 100,000 inhabitants and less, if rails of electric street railway system are properly bonded and the gas and water pipes have suitable return wire connections made from them to the power generators, there is little or no danger from electrolysis; but in larger cities, where the underground systems of pipes and conduits are more numerous and there is a greater diversity of rail system as well, thorough electrical surveys should be made by competent electrical engineers to determine the difference of potential between the rails and earth and the gas and water pipes near them in the districts covered by the electric railway system. When the facts have been ascertained, then suitable return conductors can be placed.

The Beal Valve for Gas Works.

On February 13th last U. S. Letters Patent (No. 643,393) were granted to Mr. Thaddeus R. Beal, of New York, for certain improvements in valves for gas works. Using the words of the specification:

The invention relates more especially to multi-way rotary plug valves designed for use in place of the centerseals or center valves now commonly employed in connection with the purifying apparatus of gas works. The ordinary centerseals or valves have many disadvantages, especially where large pipes are employed, principally on account of their complex arrangement, the difficulty and expense of making the large castings required, and the practical impossibility of keeping the valves gas tight. The general type of valve herein illustrated and described has known advantages over these centerseal valves and has been used to some extent; but, owing principally to the fact that when the gate or movable valve is co-operating with certain of the valve seats others of the seats are left exposed and subject to corrosion and injury from impurities deposited thereon by the gas, they have not come into general use, for unless the movable part or gate of the valve makes a gas tight joint with the faces of the several seats leakage results and the waste increasing soon renders the device useless. In the present invention those of the valve seats that are uncovered or exposed when the valve proper is in certain positions are covered and protected by what I call a "dummy valve," which does not interfere with the free flow of the gas, but whose only function is to cover the faces of the seats which would otherwise be exposed and which effectually prevents any corrosion or deposit on their faces such as would prevent the gate from making a perfectly gas tight contact therewith. Ancillary to this feature the invention also contemplates the liquid sealing of the valve joints, (preferably with oil) so as to insure their perfect gas tightness, and other features of minor importance are the manner of supporting the movable valve and relieving the seats of its weight in connection with this oil sealing of the joints and the means for operating the valve gate and other moving parts.

The invention is fully illustrated in the accompanying drawings, wherein:

Fig. 1 is a plan view of the entire valve, part of the top casing being broken away to show the arrangement of parts under the same. Fig. 2 is a vertical central section of the valve on the line 2 2 of Fig. 1. Fig. 3 is a horizontal section of the valve on the line 3 3 of Fig. 2, and Fig. 4 is a vertical section of the valve on the line 4 4 of Fig. 3

Referring to the views, *a* denotes the casing, with respect to the form and exterior contour and arrangement of which the present invention is not concerned.

The letters *b* indicate the pipes leading into and from this casing, of which there are only four shown, but of which there may be two less or any number greater than four. The pipes are arranged at angles one to another, the particular inclination of which will depend largely on the number of pipes employed, as they all radiate from the casing. At the apexes of these angles, on the inside of the casing, are the stationary valve seats *c*, of which there are four shown in the drawings. Co-operating with these seats are the faces *d d* of a rotary plug valve *e*, the seats being arranged in a circle at appropriate intervals around the interior of the casing and being themselves slightly concaved horizontally, so that the frame of the rotary valve *e*, which is circular, may revolve within them and have the faces *d d*, which are slightly convexed, fit them all accurately as the plug turns. The con-

Fig. 1.

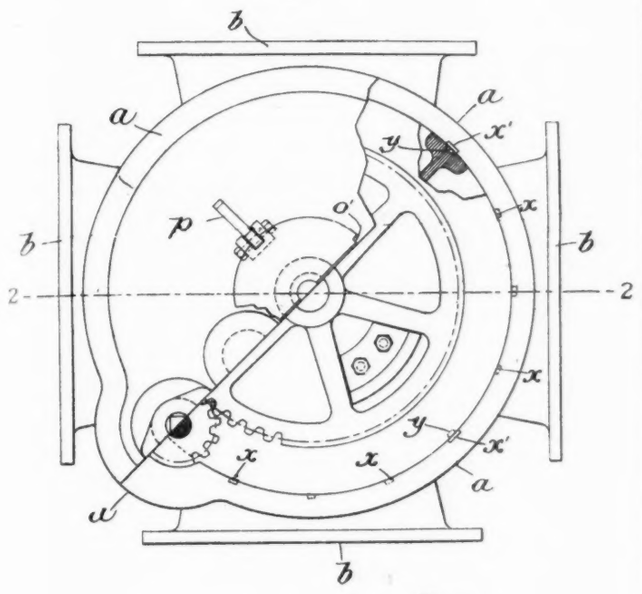


Fig. 2

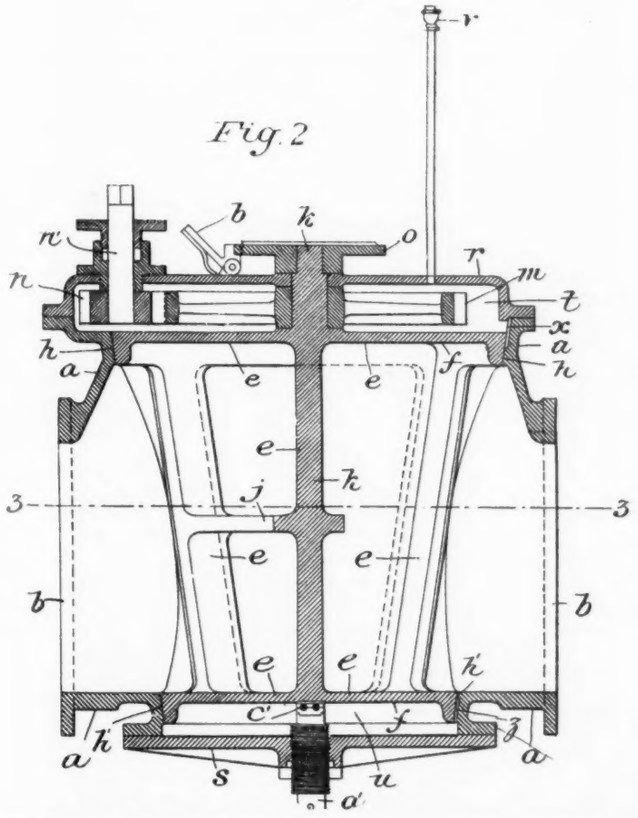


Fig. 3.

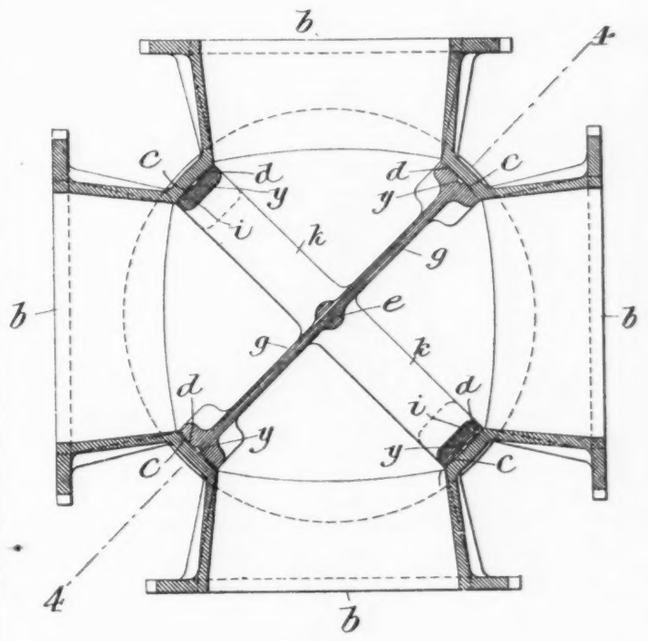
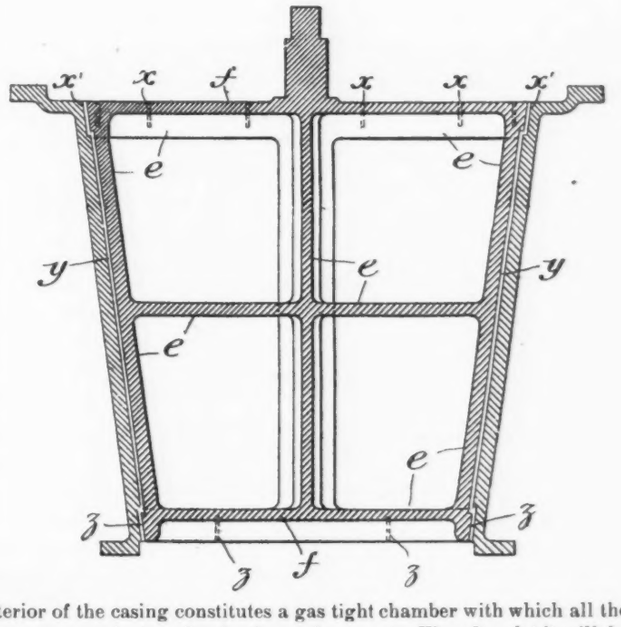


Fig. 4.



struction of this valve is best shown in Figs. 2 and 4, which are vertical sections of it, taken at right angles to each other. In these views the valve will be seen to consist of upper and lower imperforate circular plates or heads *f f*, and an imperforate gate *g*, which constitutes the valve proper and which unites the heads together and extends diametrically across them and the circular opening between the valve seats, so as to divide the interior of the casing into two parts, into one of which two of the pipes lead and into the other of which the other two pipes lead. At the top of the casing there is an annular rim or surface *h*, which is continuous all around the inside of the casing and which forms a seat or bearing for the upper head of the valve and makes with its edge a gas tight joint. At the lower end of the casing there is a similar annular rim or surface *h'*, which forms a bearing or seat for the bottom plate of the valve. These two annular surfaces are located in the casing, the one above the openings of the pipes and the other below the pipe openings, so that when the valve is in place the interior of the casing constitutes a gas tight chamber with which all the pipes communicate. On further reference to Figs. 2 and 4 it will be seen that the head plate of the valve is of greater diameter than the bottom plate and that the annular seats *h h'* have the same relation as to diameter, the effect of which is to give the interior space of the casing and the valve itself a downwardly tapering form. As before described, the stationary valve seats are located at points around the interior of this casing between adjacent openings. This is best shown in Fig. 3, and from Fig. 4 it will be seen that these seats extend vertically in an inclined direction from the upper rim *h* to the lower rim *h'*. On the vertical edges of the gate *g* are the faces *d d*, heretofore referred to, and it will be understood from the preceding description of the movable valve that this part of the valve is adapted to co operate with all the stationary seats in the casing, but that in any given position of the valve the faces *d d* will only bear against the diametrically opposite ones of the seats *c*, and that the other seats will be exposed, unless some other provision be made for covering and protecting them at such time. In whatever position the movable valve may be the gas entering

the casing through one pipe is directed by the gate into the adjacent pipe, and in flowing through the casing must pass across the face of the stationary seats that for the time being are not covered by the faces *d d* of the gate, and in the operation of the valve it soon results that these seats become corroded and covered with impurities that prevent the faces from making gas tight joints therewith, as heretofore explained. To prevent this destruction of the seat faces, I provide the movable part of the valve with what for want of a better term I call "dummy valves" *i i*, but which are really nothing more than shields or covers for those valve seats that except for such covers would be exposed when the valve proper is co operating with the other seats. These dummy valves have a fixed relation with the movable gate and consist of flat plates or bars located diametrically opposite each other and equidistant between the faces *d d* and at a distance from each face exactly equal to the distance between the stationary seats. The shields *i i* extend from the head plate of the valve to the foot plate and are further supported by arms *j*, projecting from the shaft or axis *k* of the gate, about centrally of its length, leaving the space between them and the gate free for the unobstructed flow of the gas, but entirely covering the faces of the seats. Such is the construction and operation of the movable part of the valve. It is preferably made in a single casting and of a tapering, plug like form, the dummy valves being carried by a sort of skeleton frame rigid therewith. As thus constructed it is seated to revolve in the bearing rims at the top and bottom of the tapering interior space of the casing and has its shaft *k* extended upward through the top or cover *l* of the casing, as shown in Fig. 2.

The means for moving the valve are clearly shown in Figs. 1 and 2, where *m* indicates a large gear-wheel rigid with the shaft of the gate, and *n* denotes a power pinion journaled in the casing and meshing with the gear, the relation of the pinion to the gear being as one to four. The shaft of the pinion is denoted by *n'*, and it extends up and out through the top of the casing, as shown in Fig. 2, and its end is squared or otherwise adapted for the temporary attachment of a hand-crank. The shaft of the gate is provided outside the cap of the casing with a disk *o*, provided with notches *o'*, into any of which is adapted to engage a spring latch *p* on the casing top. The object of this notched disk and latch is to lock the gate in any of its positions, and the notches are so located that when the latch engages them the movable valve will be on one or another of its seats.

In order to insure that the joints between the movable parts of the valve and the stationary seats and rims in the casing shall be gas tight, I provide for sealing them with liquid (preferably oil) in the following manner: The head and bottom plates make, as before explained, gas tight joints with the upper and lower annular rims above and below the pipe openings and, together with the top plate or cap *r* of the casing and the bottom *s* of the same form closed chambers *t* and *u*, respectively, above and below the working parts of the valve. I utilize these chambers as receptacles for the oil to seal the joints and also for the purpose of lubricating the gearing for moving the gate and the anti friction bearings on the adjustable support at the bottom, this gearing and bearings being entirely inclosed in the respective chambers and being thus arranged to run in oil.

For the purpose of filling the upper chamber with oil and obtaining the necessary pressure to effectually seal the joints, I preferably provide an elevated cup *v*, and for the purpose of supplying the joints with oil I form in the annular rim *a* a number of grooves *x*, which are open at the top and in constant communication with the oil chamber *t*, but are closed at the bottom, or, in other words, do not extend the entire depth of the rim. There may be any number of these grooves, and they may be arranged, so far as sealing the joint between the head and the rim is concerned, at any desired points and either in the rim or on the exterior surface of the edge of the head plate, or both, and the effect is to smear the surfaces of the rim and the head plate with oil as the valve moves and keep the joint or minute space between them filled and sealed with the liquid. For the purpose of sealing the joints between the spaces *d* of the working parts of the valve and the stationary seats *c* it is essential that certain of these grooves be arranged in the rim in line with the seats and that they extend below the ends of those grooves in the rim proper, as show at *x'*, and I provide the entire length of the faces *d* of the gate with similar grooves *y*, the upper ends of which extend above the lower ends of the grooves *x'*, but do not extend above the rim *h* or communicate directly with the oil chamber and never communicate with the oil chamber at all except when they register with the lengthened grooves *x'* on the seats *c*.

The arrangement just described seals the joints between the movable and stationary parts in the upper portion of the valve casing, and in order to seal that between the bottom plate and the rim *h'* I provide the latter with upwardly extending grooves *z*, precisely like those lettered *x* in the upper rim, into which the oil in the chamber *u* may rise, and in order to get the oil from the upper chamber into the lower one I make the grooves *y* in the faces of the gate and the dummy valves *i* extend below the upper ends of those of the grooves *z*, which are in line with the stationary seats, so that when the upper ends of the grooves *y* register with the grooves *x'* there will be a free passage for the oil along the faces of the valve and its seats down to the lower chamber, permitting the oil to pass down and fill the latter. It will be understood from this description that when the valve is on either of the seats there is oil supplied to the meeting faces of the parts and that the communication between the grooves in the face of the movable parts and both oil chambers is cut off immediately on the valve leaving the seat, so that there can be no leakage or waste of oil from the upper chamber while the valve is moving from one seat to another The faces of the dummy valves or seat covers *i* are grooved in precisely the same way as those of the valve proper.

In connection with the tapering form of the valve and its bearings and seats and the oil sealing of the joints I provide an adjustable support for the entire movable structure of the valve, such support consisting of a step-bearing *a'*, tapped into the bottom of the valve casing, and an anti-friction or ball bearing *c'* between the support and the valve. As will be understood, the valve is very heavy and presses with great force outwardly on the tapered bearings and seats, making it difficult to handle quickly and such great pressure at the joints being really unnecessary, especially when the joints are oil sealed, I am enabled by this means to make such fine adjustments of the movable parts that the stationary seats and bearings are relieved of the weight and yet to have the parts in contact with one another, or if not in actual physical contact then in such intimate proximity that the capillarity of the minute space between them will hold the oil film against dislodgment by pressure of the gas and produce a perfectly gas tight joint or connection.

Such being the construction and general operation of the parts, no further description of either seems necessary, except perhaps to state that although the only construction illustrated and described herein is a circular four way value the improvements claimed are applicable to any other form of valve having the same general characteristice, and that I do not desire or intend to be limited to the particular constructions and arrangements of parts herein set forth.

The elevation of the oil cup *v* provides a convenient means for obtaining the necessary head or pressure of oil to insure that it finds its way between the valve faces, even though the valve may be in operation at the time, and also to prevent the dislodgment of the oil film seal either by the gas pressure within the casing or otherwise, and for that purpose the pressure of the oil is preferably made superior to that of the gas.

The inventor's claims are:

1. In a gas works valve, the combination of a stationary seat, a movable valve adapted to co operate therewith, a source of oil supply, and grooves or depressions in the face of the movable valve, said grooves or depressions communicating with the oil supply when the valve is on the seat and the communication being cut off when the valve leaves the seat.

2. The combination of a plurality of stationary seats, a movable valve adapted to co-operate with either of said seats, a source of oil supply communicating with grooves or depressions in the face of one of the parts, and means for closing said communication while the valve is moving from one seat to another.

3. The combination with the casing, of a plurality of stationary seats, a movable valve adapted to co-operate with either of said seats, an oil chamber in the casing, and grooves or depressions in the valve and seat, those in the seat being in open communication with the oil chamber, and being adapted to communicate with that in the valve when the latter closes on the seat.

4. The combination with the casing, of a plurality of seats annularly arranged at intervals therein, a rotary plug valve having a face adapted to co-operate with any of said seats, a gear wheel rigid with the valve and housed in said casing, a power pinion meshing with said wheel and housed and journaled in said casing with its shaft projecting therethrough, a disk on the shaft of the valve outside the casing, notches in said disk corresponding to the number of valve seats within the casing, and a latch adapted to engage said notches.

5. The combination with the casing and pipes leading into and from the same, of a plurality of stationary vertical valve seats arranged within the casing, a sliding valve consisting of horizontal plates co-operating with bearing faces in the casing above and below the pipe openings, and a vertically arranged valve extending between the plates and having a face adapted to co operate with any of the seats, chambers in the casing above and below the horizontal plates of the valve and their bearing faces, grooves or depressions in the valve seats in open communication with said chambers, and a similar groove or depression in the face of the movable valve, the groove in the face of the valve being adapted to register with those in the seats when the valve is seated thereon so as to establish communication between the upper and lower chambers when the valve is closed in any position.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE City Council of Faribault, Minn., has consented to an extension of the franchise of the Faribault Consolidated Gas and Electric Light Company for a period of 20 years.

WE understand that the syndicate organized by Mr. D. R. Russell, of St. Louis, Mo., has secured control of the Winchester (Va.) Gas and Electric Light Company.

MR. SILAS B. COBB, who served as a Director in the old Chicago Gas Light and Coke Company, from 1855 to 1887, died in Chicago, the morning of the 5th inst. He was in his 88th year, and had been a resident of Chicago since 1834. The bulk of his large fortune is traceable to his early connection with railroad construction, he, with Mr. Watkins, who will be remembered as the executive head for many years of the Chicags Gas Light and Coke Company, having been concerned in the construction and operation of the Chicago and Galena Union and the Beloit and Madison Railroads, which are now incorporated in the Northwestern system.

THE City Council of Alexandria, Va., has accepted the resignation of the City Engineer, Mr. E. C. Dunn.

MR. J. D. TAYLOR, JR., formerly agent for Branch 2, Bergen district of the Hudson (N. J.) Gas Company, is now in Denver, Col., because of impaired health. Prior to his taking up with the old Hudson County Gas Light Company, of Hoboken, N. J., whose stove department he managed with much success, he had been employed by the Wm. M. Crane Company.

AT the annual meeting of the Glens Falls (N. Y.) Gas and Electric Light Company the Directors chosen were: Richard S. Storr, Frank S. Butterworth and F. A. Sabbaton.

MR. A. G. B. HUNT has been appointed Assistant Superintendent of the New London (Conn.) Gas and Electric Company.

MR. H. G. JOHNSON, who resigned the position of Superintendent to the Fond du Lac (Wis.) Gas Light Company when that property was taken over by its new owners, was, on retiring, presented by his former employees with a handsomely mounted pearl penholder carrying a gold pen.

THE Berlin Iron Bridge Company, of East Berlin, Conn., will remove its New York Offices on May first to the St. Paul Building, No. 220 Broadway. The office will continue in charge of Mr. Seymour N. Robinson, whose well known urbanity sums inexhaustible.

MESSRS. James Gamble, Avery C. Sickles, J. C. Durbin, J. G. Diffenderfer and B. T. Dickinson are named as the incorporators of the Steelton (Pa) Gas Company, the object of which as set forth is "to manufacture and supply gas for light, heat, fuel and power to the public of the borough of Steelton and the townships of Swatara, Lower Swatara and Susquehanna." The named places are tributary to the city of Harrisburg.

AT the organization meeting of the Board of Directors of the Trenton (N. J.) Gas and Electric Company the officers chosen were: President, Henry C. Moore; Vice-President, Thomas C. Barr; Secretary and Treasurer, A. R. Kuser; Manager, Richard Stockton.

THE new holder for the Troy (N. Y.) Gas Company is to be located on the river bank, between Bond street and Smith avenue. The holder is to have a capacity up to retaining 600,000 cubic feet.

THE project to construct a gas works at Durango, Cal., is again in the dialogue stage. It is not likely, however, that it will get much beyond that point, so writes "A. T. C.," from Denver, under date of the 12th inst. We are not quite so certain as our correspondent is over the failure, since we know that responsible parties have been looking into the existing franchise rights with a view to going ahead, if matters were found to have been truthfully represented.

MESSRS. STREET, WYKES & Co., of New York, have purchased the gas property heretofore operated in Kankakee, Ills, by Messrs. Wetherell & Shores. The new owners, who are now in possession, propose to reconstruct the manufacturing plant and to largely extend and improve the main system. Mr. F. C. Street will likely be named executive head of the new concern, but the formal organization thereof has not yet been perfected.

MR. GOTTLIEB DAIMLER, who assisted Dr. Otto in the development of the gas engine, died March 5th.

THE Directors of the Consolidated Gas Company, of Baltimore, Md., have decided to contest in the courts the validity of the recent act of the Maryland Legislature, which directed that the Company should not charge to exceed $1.10 per 1,000 cubic feet for its product.

THE following advertisement is appearing in the newspapers of the district supplied by the Philadelphia Suburban Gas Company, Darby, Pa.:

"*Summer Gas Rates.*—A discount, from May 1st to October 1st, 1900, will be allowed for gas consumed for cooking and lighting, through a single meter, as follows—the gross rate will be $1.50 per 1,000 cubic feet:

Quantities from	100 to 1,000 cu. ft.,	10c.	per 1,000 cu. ft.	discount.		
"	" 1,100 to 2,000	"	20c.	"	"	"
"	" 2,100 cu. ft. and over,	25c.	"	"	"	

"This discount will be allowed to all consumers whose back gas bills are paid in full to date, and who have no merchandise bills of over 60 days' standing, or who pay current gas bill by the 10th of the month rendered."

A CORRESPONDENT incloses the following, from the Chicago (Ills.) *News*, dated the 16th inst.: "Henry B. Chichester, General Superintendent of Streets for the Peoples Gas Light and Coke Company, this city, died at his residence, 3,331 Indiana avenue, at an early hour today. Mr. Chichester has for a number of years been associated with prominent gas interests. Born in 1853, he became connected, when 17 years old, with the Bayonne and Greenville Gas Light Company, of Bergen Point, N. J. He afterward installed a gas plant in Davenport, Iowa, and was later on Superintendent of the Knickerbocker Gas Company, of New York. In 1880 Mr. Chichester laid out the system of gas street mains in Havana. In 1881 he came to Chicago to take charge of the street work for the Chicago Gas Light and Coke Company. He has since been associated with the Consumers Gas Company, the Hyde Park Gas Company, the Lake Gas Company and the Chicago Economic Fuel Gas Company. When the several Gas Companies in this city were amalgamated under the charter of the Peoples Gas Light and Coke Company, Mr. Chichester was appointed its general superintendent of streets."

MR. C. H. EVANS, of Chicago, has been appointed to manage the construction of the new plant for the Oshkosh (Wis.) Gas Light Company.

THE proprietors of the Jeffersonville (Ind.) Electric Light, Gas Heating and Coke Company have determined to put the plant in good working condition. As further evidence that they mean business, a new selling schedule is being prepared, the same to take effect June 1st.

THE Common Council of Manitowoc, Wis., has finally agreed to grant a franchise for the operation of a gas works there to Messrs. John Nagle, Henry Kits, M. H. Dempsey, Julius Lindstedt and Emil Teitgen, who are all residents of Manitowoc. The franchise is to run for 25 years, and it is especially designated that "the grant is not exclusive."

AT the annual meeting of the Knoxville (Tenn.) Gas Light Company the officers elected were: Directors, R. R. Swepson, L. P. Spilman, E. H. Saunders, W. P. Washburn, F. L. Fisher, J. Y. Johnson and J. E. Hood; President, R. R Swepson; Vice President, L. H. Spilman; Treasurer and Secretary, E. H. Saunders.

AT the annual meeting of the Flatbush (L. I.) Gas Company these officers were elected: Directors, Felix Campbell, Edward Johnson, W. A. Stedman, C. H. Eicks, C. L. E. de Gaugue, Geo. R. Evans and E. L. Jones; President, C. H. Eicks; Vice President and General Manager, W. A. Stedman; Secretary, C. L. E. de Gaugue.

THE Lawrence (Mass.) Gas Company has placed the contract for a steel roof for its new retort house with the Berlin Iron Bridge Company, of East Berlin, Conn. The covering will be of the Bridge Company's patent anti-condensation, corrugated iron roof covering material.

MESSRS. LESLIE & GILBERT, who have been operating under lease the properties of the Hopkinsville (Ky.) Electric Light Company, have stepped down and out, their successor being the Hopkinsville Gas and Lighting Company.

(*Concluded on page* 658.)

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
MANAGER.

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Notification Respecting Advertising.—Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:

New York—American News Co. 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, APRIL 23, 1900.

(*Continued from page* 657.)

THE proprietors of the Paris (Ills.) Gas Light and Coke Company have, we are told, decided to try on much more than an experimental scale, the distribution of hot water heating as carried out under the Yaryan system, provided the necessary franchise can be obtained.

THE Brunswick Gas Company, to manufacture and distribute gas in the towns of Brunswick and Topsham, Maine, has been organized by Messrs. Weston Thompson, H. F. Thompson, H. A. Randall, A. C. Hopkins, F. C. Webb, J. H. Henley and Edward W. Wheeler.

IT is said that the Loomis-Pettibone Company, of New York, is under contract to install a fuel gas plant in the works of the Winchester Arms Repeating Company, New Haven, Conn. It is further said that the capacity of the plant will not be less than 500,000 cubic feet per day.

LAST Tuesday the Consolidated Gas Company of this city, through its attorneys, presented to the State Board of Tax Commissioners arguments against the valuation of $15,828,600 put on its franchise under the provisions of the franchise tax law, which sum represents an increase from $5,635,000. Mr. Frank H. Platt represented the Company and presented to the Board several new questions in relation to the operation of the law. He contended that the Board should take into consideration the fact that local assessors do not assess property at its full value and that it should in each tax district follow the standard set by the local board.

"The law charges us with assessing the franchise at its full value," remarked Commissioner Stearns. Continuing, the latter said: "Local assessors are also charged with the duty of assessing property at its full value. We have been striving to get the local assessors to perform their duty, and some who have not have been indicted. Because they do not assess at full value gives us no right to assess at anything less than full value. As a matter of equity, assessments should be uniform. The courts have reduced them where they have been excessive, but the courts have also held that where the law says property should be assessed at its full value it cannot be assessed at anything below that figure." Mr. Platt persisted that the Board could use the same discretionary power as that exercised by the local assessors, and that the former should follow the standards established by the latter. The Board declared that it could but follow the law, remitting the equity of the valuation to the courts. At this point the question of the power of the Board was raised. Mr. Platt also contended that the Board should discriminate between the franchise of a street railroad company, which gives it the right to raise the surface of a street, which was to a degree an interference with the public use of a street, and the franchise of a gas company, which simply buries its pipes beneath the surface of the roadway with no inconvenience to the public. The hearing was a very interesting one.

Engineering Record notes that a submerged pipe line with a rather interesting history has been conveying water to Governor's Island, New York Harbor, across Buttermilk channel from Brooklyn. When this was first laid, many years ago, it was a cast iron pipe with ordinary rigid joints. It was superseded by a wrought iron pipe with screwed joints, which was eaten through by the action of the salt water. It leaked so badly after a time that it was necessary for a diver to patch it in several places by belting around it clamp sleeves with rubber gaskets. As the pipe continued to fail, it has now been replaced by a 6 inch cast iron pipe, 1,800 feet long, with Ward joints, which has recently been laid and will soon be put in use. This pipe is laid on the hard bottom of the harbor with a maximum depth of 44 feet and a tide of over 4 miles an hour. The pipe was received in standard 12-foot lengths, weighing from 660 to 700 pounds each. Ten lengths were connected together on the Brooklyn shore, and the front end closed with a wooden plug. Two empty kerosene barrels were attached to the first length and one barrel to each succeeding length, and the whole section was pulled forward nearly its own length by a Lidgerwood hoisting engine on Governor's Island. An 8-length section was assembled and connected to the shore end of the first, the whole pulled forward 96 feet more, and so on, until, in five days, the whole line was carried across. Some boulders and other obstructions were encountered and were removed by a diver who went down twice, and reported that the two barrels on the first length of pipe sufficed to raise it slightly above the bottom and prevent its ploughing under, while the rest of the pipe had sufficient weight on the bottom to give it secure bearing. The pipe was assembled on a horizontal platform along the edge of a dock, and was slid into the water on an inclined trough cradle 60 feet long. The angle with the platform at the upper end of the cradle was eased off so that it could be taken up by two pipe joints, and the cradle was pivoted at the top and suspended at the lower end. The hauling rope was a second-hand 2-inch cable, which had been used by the Metropolitan Street Railway Company, and was carried around one of its older foot sheaves, which was anchored to a "dead man" on Governor's Island. A 6-part tackle was anchored and made fast to the end of the hauling cable and its fall line was operated by a 4-part luff tackle, led to the engine. The work was done under the direction of Major S. R. Jones, Quartermaster, U. S. A., by the United Engineering and Contracting Company, New York.

The Market for Gas Securities.

There wasn't any market for local gas securities last week, and whatever trading was done was accomplished at figures well below those for the preceding week. The slump in Consolidated was quite pronounced, sales having been recorded for odd lots a shade under 182. The opening to-day (Friday) was 182 to 185, and quite some business was done between 182 and 183, with the latter offered for it at the close. Amsterdam common was 27½ to 28¼, and the preferred was heavy and neglected at 47 to 50. Mutual is not heard from, save in a desultory way, and the quotations for it are merely nominal. Standard common is also neglected. The situation in New York city, so far as the rate war is concerned, is outwardly unchanged, but it cannot be denied that certain changes in the working forces of three of the Companies point towards agreement of the practical sotr.

The controllers of the New Amsterdam Company seem to have still more money to lose, and the controllers of the Consolidated Company appear perfectly willing that the opportunity for such loss shall continue until reason, or poverty, conquers. Meanwhile the minnows are suffering.

Brooklyn Union is about the steadiest gas thing on the list, and there is good reason for the steadiness; big business accomplished at the legal gas rate would seem to account for its standing. It will go very much higher when "peace, perfect peace" is announced.

The general list is "spotty," but as a whole, prices are fairly well maintained. The exception is Baltimore Consolidated, but we have no hesitancy whatever in saying that it is a purchase at the market, even at the new selling rate of $1.10 per 1,000 the Company should be able to pay 4 per cent. on par.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

APRIL 23.

☞ All communications will receive particular attention

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$54,595,300	100	182	185
Central Union, Bonds, 5's.	3,000,000	1,000	103½	105
Equitable Bonds, 6's	1,000,000	1,000	105	.
" 1st Con. 5's	2,300,000	1,000	115	118
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	275	300
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	
New Amsterdam Gas Co.	13,000,000	100	27¼	28¼
Preferred	10,000,000	100	47	50
Bonds, 5's	11,000,000	1,000	98	99
Northern Union, Bonds, 5's.	1,250,000	1,000	95	97

New York and East River..				
Bonds 1st 5's	3,500,000	1,000	109	111
" 1st Con. 5's	1,500,000		115	..
Richmond Co., S. I.	348,650	50	70	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	100	116
Preferred	5,000,000	100	125	140
Bonds, 1st Mortgage, 5's	1,500,000	1,000	110	114
Yonkers	299,65	500	130	
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	150	153½
" " Bonds (5's)	15 000,000	1,000	118	119
Bay State	50,000,000	50	1⅛	1⅜
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works..	450,000	100	40	.
" 1st Mtg. 5's	475,000	1,000	96½	99½
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	..	77½
2d " " "	3,000.000	1,000	42	45
Buffalo City Gas Co.	5,500,000	100	5	6
" " Bonds, 5's	5,250.000	1,000	69	71
*Central, San Francisco	2,000,000	..	106	108
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,207,000	1,000	106	107
Columbus (O.) Gas Lt. & Heating Co	1,682,780	100	60	65
Preferred	3,026,500	100	84	86
Consumers, Jersey City Bonds	600,090	1,000	102	105
Cincinnati G. & C. Co.	8,500,000	100	195¾	196½
Consumers, Toronto	1,700,000	50	230	235
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000		..
Consolidated, Baltimore	11,000,000	100	50¾	..
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	15	19
" Con. Mtg. 5's	380,000	1,000	82	86
Consolidated G. & E. Co.'s., Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co.	4,560,000	50	95¾	96
" Prior Lien 5's	4,598,000	1,000	99½	100
Detroit Gas Co., 5's	386,000	1,000	100	101
" Inc. 5's	16,000	100	100½	101
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	35	41
" Bonds	2,000,000	..	60	64
Grand Rapids Gas Lt. Co..	1,000,000	50	..	..
" 1st Mtg. 5's	1,125,000	1,000	..	.
Hartford	750,000	25	..	220
Hudson County Gas Co., of New Jersey	10,500,000	..	25	..
" Bonds, 5's	10,500,000	..	102	105
Indianapolis	2,000,000	..	101	103
" Bonds, 6's	2 650,000	..	100	104
Jackson Gas Co.	250,000	50	72	73
" 1st Mtg. 5's	250,000	1,000	101	102½
Lafayette Gas Co., Ind.	1,000,000	100	40	45
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	106	
Laclede, St. Louis	7,500,000	100	72	74
Preferred	2,500,000	100	98	101
Bonds	10,000,000	1,000	110	110½
Madison Gas & Elec. Co.	400,000	100	82	..
" 1st Mtg. 6's	350,000	1,000	102½	108
Montreal, Canada	2,000,000	100	200	..
Newark, N. J., Con. Gas Co	6,000,000	..	..	55
Bonds, 6's	4,600,000	..	..	103
Essex and Hudson Gas Co.	6,500,000	..	35	40
New Haven	1,000,000	25	280	300
Nashville Gas Lt. Co.	1,000,000	50	110	..
Oakland, Cal.	2,000,000	..	43	45
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	104⅛	104¼
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	111⅜	111½x
2d "	2,500,000	1,000	104	105
Rochester Gas & Elec. Co..	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	54	54½
St. Paul Gas Light Co.	1,500,000	100	57½	58½
1st Mortgage 6's	650,000	1,000	82	85
Extension, 6's	600,000	1,000	..	..
General Mortgage, 5's	2,428,000	1,000	88	90½
St. Joseph Gas Co.	1,000,000	100	42	44
" 1st Mtg. 5's	750,000	1,000	96½	98
Syracuse, N. Y.	1,750,000	100	..	15
Bonds	1,612 000	1,000	85	90
Washington, D. C	2,600,000	20	273½	273¾
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	100	..	92
Bonds, 5's	3,830,500	.	104	106
Wilmington, Del.	600,000		220	50

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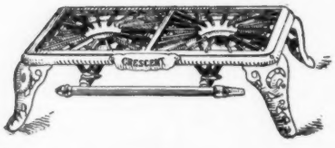

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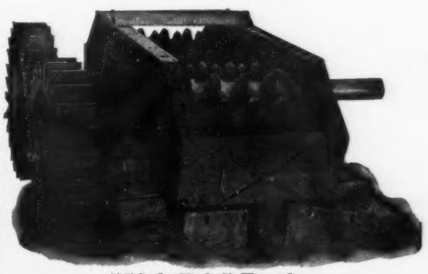

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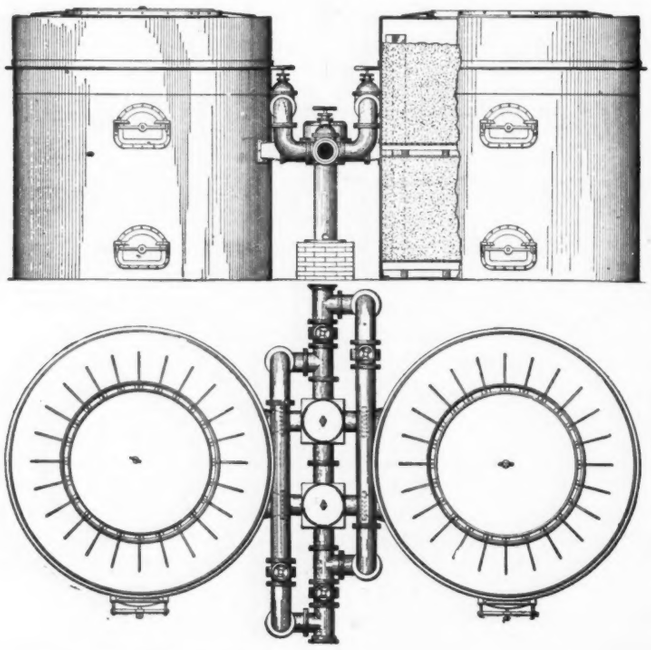

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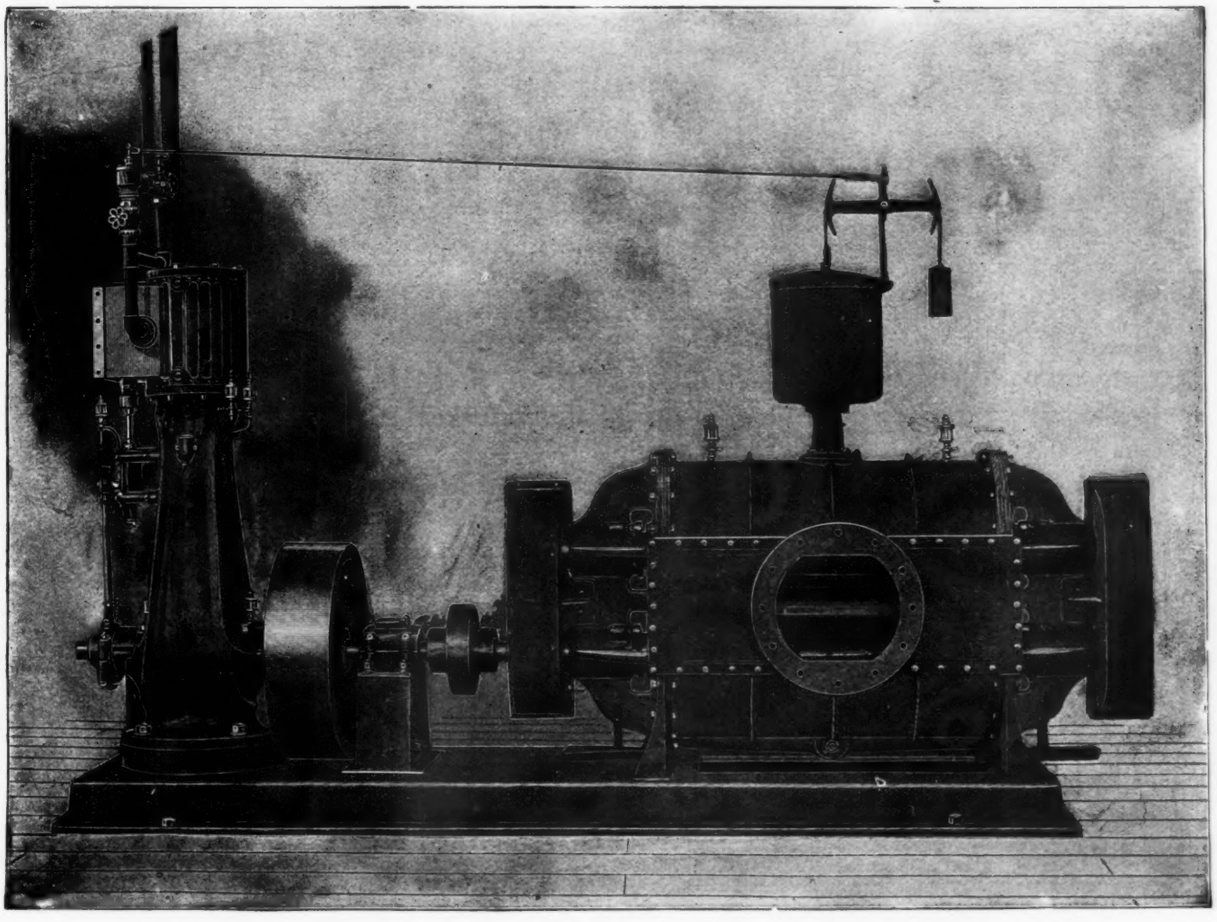

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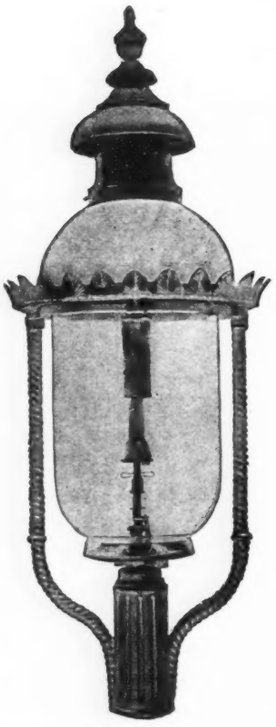

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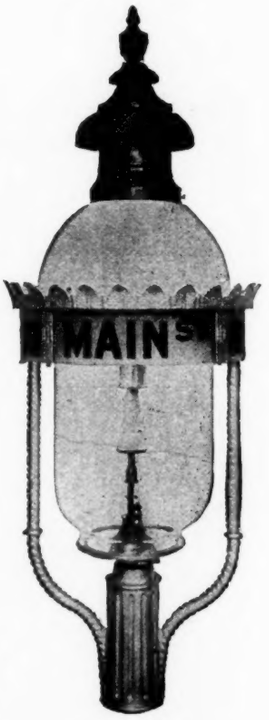

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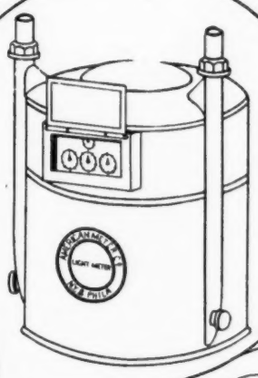

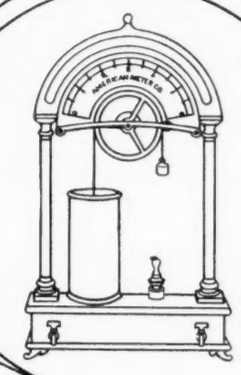

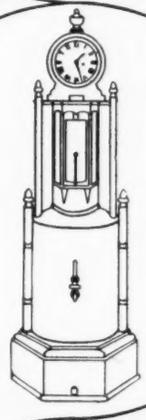

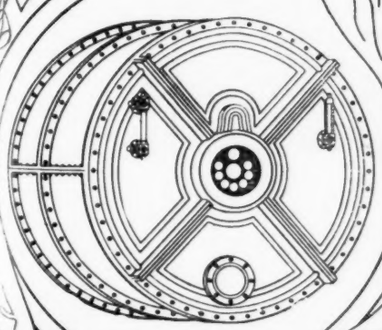

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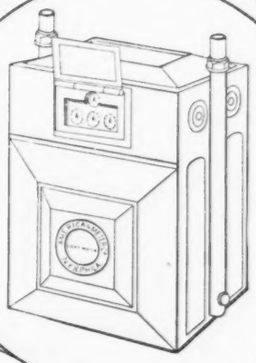

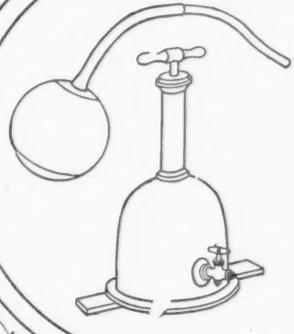

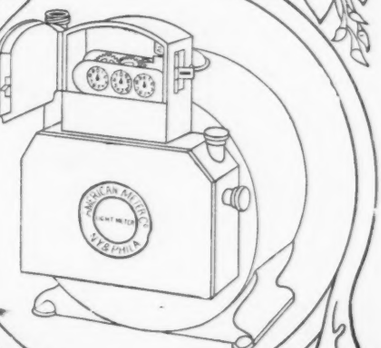

PUBLIC LIGHTING TABLE.

MAY, 1900.

Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Extinguish.
				P.M.	A.M.
Tue.	1	7.20 PM	4.00 AM	6.45	4.00
Wed.	2	7.20	4.00	6.45	4.00
Thu.	3	10.30	4.00	6.45	4.00
Fri.	4	11.10	4.00	6.45	4.00
Sat.	5	11.40	4.00	6.45	4.00
Sun.	6	12.10 AM F.Q.	3.50	6.45	4.00
Mon.	7	12.40	3.50	6.55	3.40
Tue.	8	1.00	3.50	6.55	3.40
Wed.	9	1.30	3.50	6.55	3.40
Thu.	10	1.50	3.50	6.55	3.40
Fri.	11	2.20	3.50	6.55	3.40
Sat.	12	2.50	3.50	6.55	3.40
Sun.	13	No L.	No L.	6.55	3.40
Mon.	14	No L. FM	No L.	7.00	3.30
Tue.	15	No L.	No L.	7.00	3.30
Wed.	16	7.40 PM	10.20 PM	7.00	3.30
Thu.	17	7.40	11.10	7.00	3.30
Fri.	18	7.40	11.50	7.00	3.30
Sat.	19	7.40	12.30 AM	7.00	3.30
Sun.	20	7.40	1.10	7.00	3.30
Mon.	21	7.40 LQ	1.40	7.10	3.15
Tue.	22	7.40	2.10	7.10	3.15
Wed.	23	7.40	2.40	7.10	3.15
Thu.	24	7.40	3.20	7.10	3.15
Fri.	25	7.40	3.40	7.10	3.15
Sat.	26	7.40	3.40	7.10	3.15
Sun.	27	7.50	3.30	7.10	3.15
Mon.	28	7.50 NM	3.30	7.15	3.15
Tue.	29	7.50	3.30	7.15	3.15
Wed.	30	7.50	3.30	7.15	3.15
Thu.	31	7.50	3.30	7.15	3.15

TOTAL HOURS LIGHTING DURING 1900.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	230.50	January	423.20
February	175.40	February	355.25
March	189.00	March	355.35
April	160.30	April	298.50
May	150.40	May	264.50
June	137.00	June	234.25
July	152.00	July	243.45
August	171.50	August	280.25
September	187.20	September	321.15
October	213.10	October	374.30
November	221.50	November	401.40
December	231.50	December	433.45
Total, yr.	2221.40	Total, yr.	3987.45

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The name on the mantle—
are two ways of telling the genuine

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LOWE WATER GAS APPARATUS.

Total Sets Installed to January 1, 1900, - - - - - - - - 327

Total Daily Capacity - - - - - - - - - 207,425,000 Cu. Ft.

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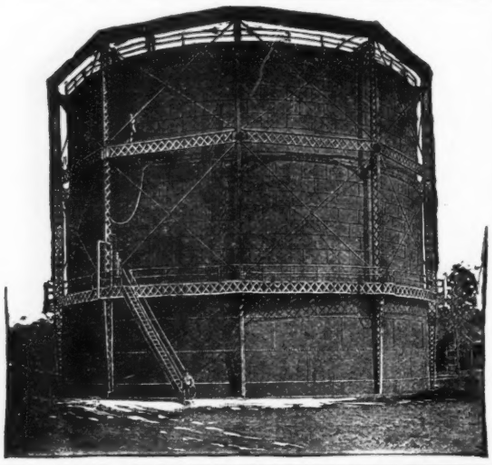

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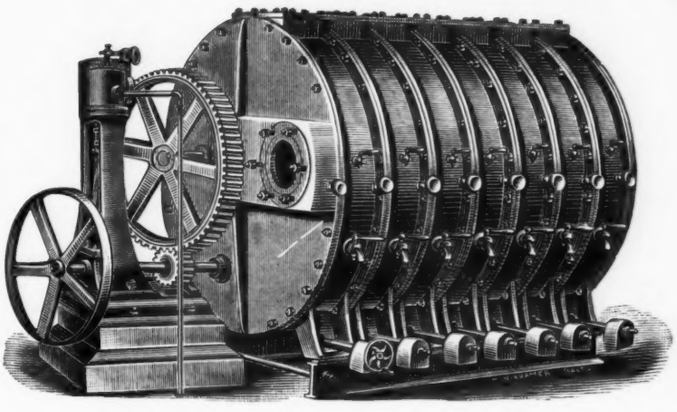

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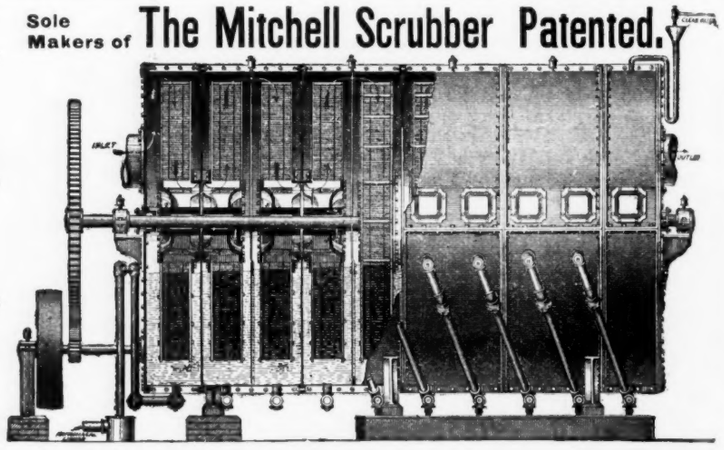

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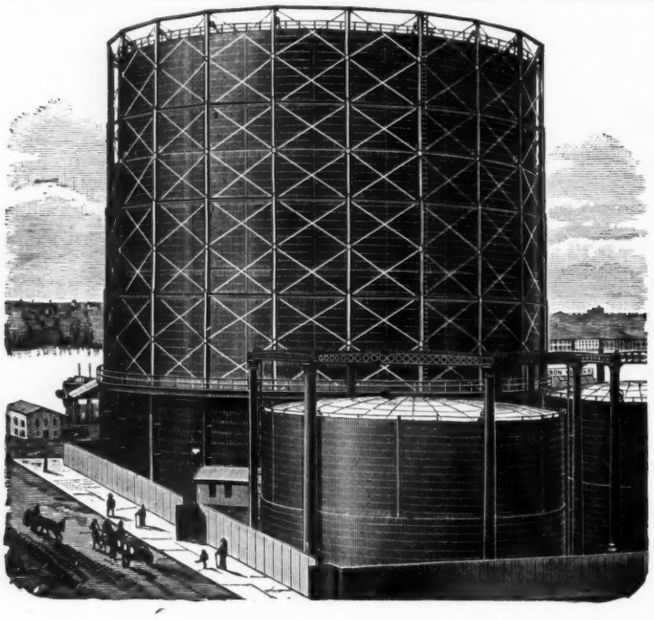

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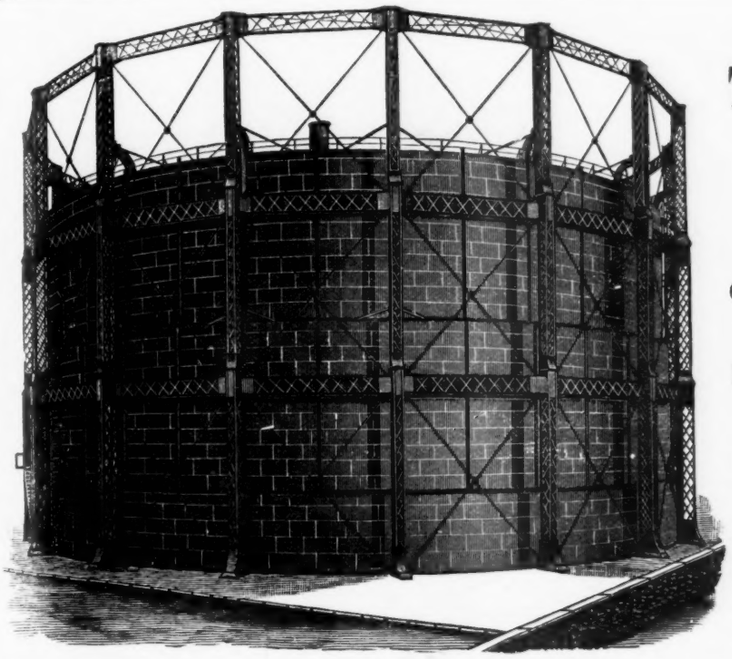

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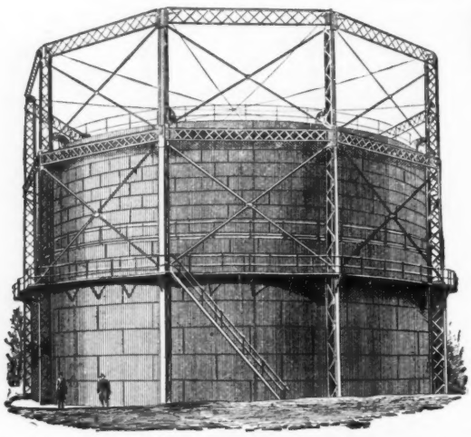

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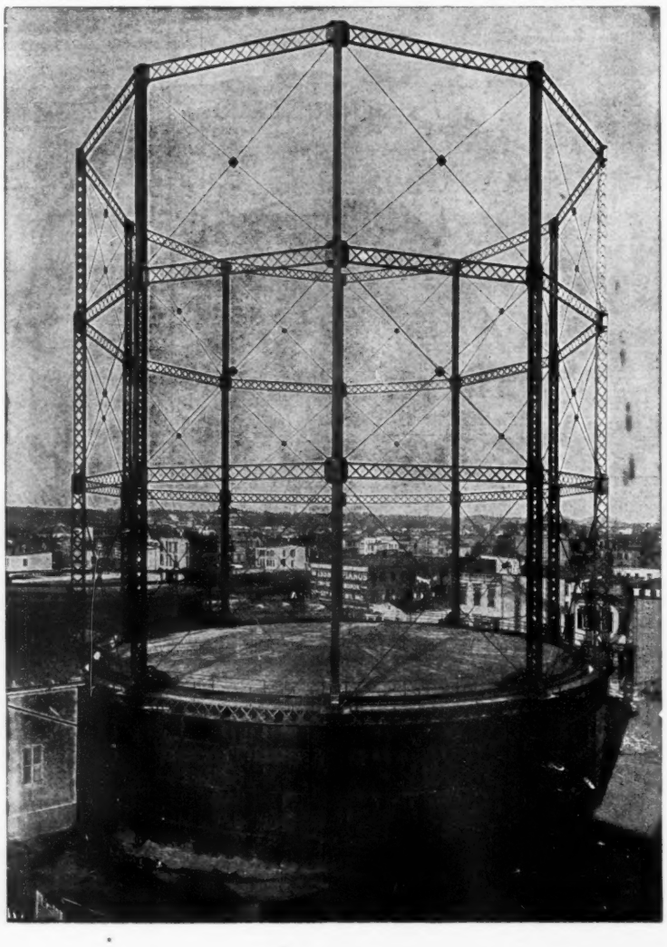

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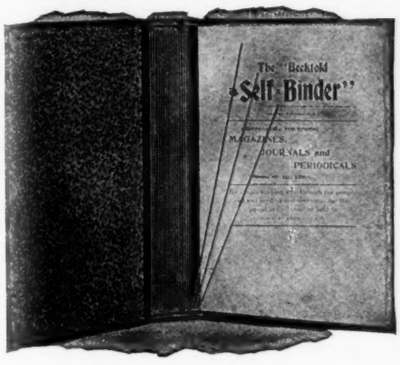

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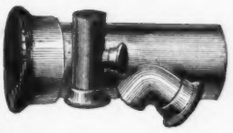

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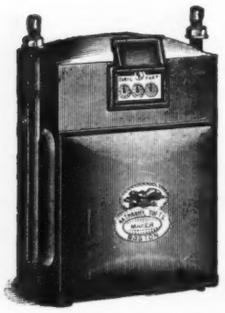

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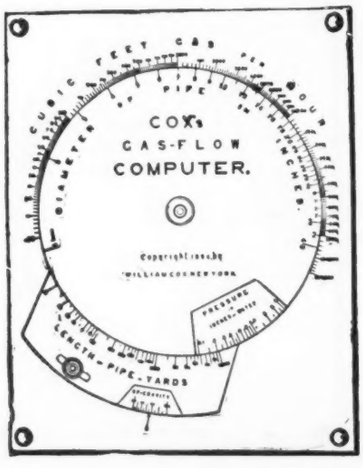

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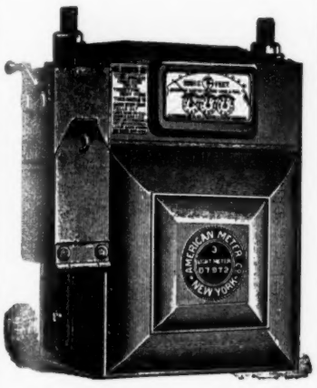

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